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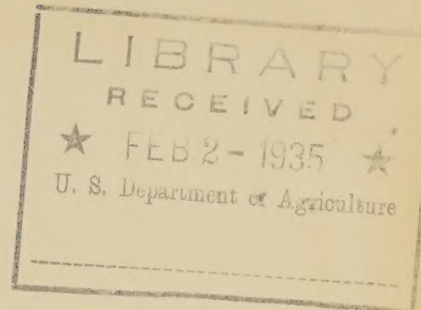
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PROPOSED INTER-AMERICAN HIGHWAY

MESSAGE FROM THE PRESIDENT OF THE UNITED STATES

TRANSMITTING

A REPORT PREPARED BY THE BUREAU OF PUBLIC ROADS, DEPARTMENT
OF AGRICULTURE, A LETTER OF TRANSMITTAL ADDRESSED TO THE
SECRETARY OF STATE BY THE SECRETARY OF AGRICULTURE,
AND A LETTER FROM THE SECRETARY OF STATE
CONCERNING A RECONNAISSANCE SURVEY
FOR AN INTER-AMERICAN HIGHWAY



MARCH 6, 1934.—Read, and with accompanying papers referred to the
Committee on Post Offices and Post Roads

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON: 1934

SENATE RESOLUTION 271

(Reported by Mr. Hayden)

IN THE SENATE OF THE UNITED STATES,

June 6 (calendar day, June 14), 1934.

Resolved, That the "Report by the Bureau of Public Roads, United States Department of Agriculture, of a Reconnaissance Survey of the Proposed Inter-American Highway from the Republic of Panama to the United States" be printed with illustrations as a public document.

Attest:

EDWIN A. HALSEY, *Secretary.*

MESSAGE

To the Congress of the United States:

I transmit herewith two copies of a report prepared by the Bureau of Public Roads, Department of Agriculture, a letter of transmittal addressed to the Secretary of State by the Secretary of Agriculture, and a letter from the Secretary of State concerning a reconnaissance survey for an inter-American highway.

FRANKLIN D. ROOSEVELT.

THE WHITE HOUSE,
March 6, 1934.

Copies of this publication may be procured from the
Superintendent of Documents, U.S. Government Printing Office
Washington, D.C., at 70 cents per copy

LETTER OF SUBMITTAL

DEPARTMENT OF STATE,
Washington, March 5, 1934.

The PRESIDENT:

Pursuant to the act of Congress approved March 26, 1930 (Public, No. 78, 71st Cong.), I beg to submit herewith, for transmission to the Congress, two copies of a report of a reconnaissance survey for an inter-American highway between the Republic of Panama and the United States, together with a letter of transmittal from the Secretary of Agriculture dated January 25, 1934. As shown in that letter, the report was prepared by the Bureau of Public Roads, Department of Agriculture, which Bureau was the agency selected to cooperate with the several governments, members of the Pan American Union, which signified a desire to participate in the surveys. A third copy of the report, for your personal use, is also submitted.

The report contains a description of the selected route with accompanying diagrams of line and profile and there appears in regard to each country which will be traversed by the highway, a general statement of the principal facts of an economic nature related to the proposed enterprise. There is also included in the report a series of airplane photographs as well as other pertinent information regarding the proposed highway.

In submitting the report, I desire to acknowledge the helpful cooperation which has been received from officials of the several interested governments.

That of Panama not only collaborated with the representatives of this Government in connection with the survey conducted through that country but also generously provided, free of rent, office space in which were established the headquarters of the officials conducting the surveys throughout the 3-year period during which the work was in progress. Valuable assistance was also received from officials of the Governments of Costa Rica, Nicaragua, Honduras, and Guatemala in connection with the reconnaissance surveys made in these countries. While the Governments of El Salvador and Mexico did not make an official request for cooperation through the Pan American Union as provided for under the act of Congress, since the route through those countries had already been largely determined and the highway partly constructed, nevertheless officials of both of these Governments furnished important information regarding the route selected and highways completed in their respective countries.

Respectfully submitted.

CORDELL HULL.

DEPARTMENT OF AGRICULTURE,
Washington, January 25, 1934.

The SECRETARY of STATE:

DEAR MR. SECRETARY: I am forwarding herewith three copies of a report of a reconnaissance survey for an inter-American highway submitted by the Bureau of Public Roads of this Department in accordance with an interdepartmental agreement of February 24, 1931, under which the Bureau of Public Roads has conducted the surveys, and in accordance with paragraph (6) of which the Bureau has prepared a final report for submission to Congress.

Attention is called to the suggestion relative to printing contained in the letter of transmittal of the Chief of Bureau.

Sincerely,

H. A. WALLACE, *Secretary.*

LETTER OF TRANSMITTAL

DEPARTMENT OF AGRICULTURE,
BUREAU OF PUBLIC ROADS,
Washington, D. C., January 22, 1934.

The SECRETARY OF AGRICULTURE.

SIR: I am transmitting herewith report of a reconnaissance survey for a highway between the Republic of Panama and the United States made by this Bureau during the years 1930 to 1933.

Provision for this work was carried in an act of Congress (Public, No. 78, 71st Cong.) and has been done by this Bureau under a memorandum agreement between the Secretary of State and the Secretary of Agriculture, dated February 24, 1931, according to paragraph (6) of which the Bureau of Public Roads is authorized to prepare a final report to Congress as contemplated by the act.

The report is voluminous and detailed and recites the circumstances incident to the inception of the project. It includes not only the usual and necessary description of the selected route with the accompanying diagrams of line and profile but also for each country a general statement of the principal facts of an economic nature related to the proposed enterprise and a series of airplane photographs which were necessary, in the absence of adequate maps, to determine the relation of topographic and hydrographic features.

Mindful of the importance of highway construction in relatively undeveloped countries, the Congress provided for the inclusion of economic data, and such material has been included as appears helpful and necessary. Such facts are presented as are likely to assist in determining the probable effect of construction on the economic progress of the several republics, and the relation of construction costs to the national wealth and to the present debt structure. Attempt is made to indicate the effect of the proposed highway on the distribution of domestic products and in facilitating the delivery of export goods to railways and ports; the possible development of diversified agricultural production; and the opening of new regions to settlement. Facts are given relating to present rail-road, highway, and steamship transport, including present and potential routes for systematic highway transportation of both passengers and goods. The possibilities of developing national highway systems about the proposed project are made obvious throughout the report. Special attention is called to the relation and importance placed upon overland communication with American interests in the Panama Canal Zone. As a ground line for guiding air service and as a line for a series of properly distributed airports, the projected route would be of inestimable value.

Five copies of the report have been prepared, including complete sets of the airplane photographs, and it is suggested that in printing these photographs be omitted, as their adequate reproduction would be difficult and expensive. The drawings and maps should, however, be printed by the usual means.

Three copies of the complete report are furnished herewith to be forwarded to the Department of State, two of which are for the Congress.

Very truly yours,

THOS. H. MACDONALD,
Chief of Bureau.

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PROPOSED INTER-AMERICAN HIGHWAY

REPORT OF A RECONNAISSANCE SURVEY FOR THE
PROPOSED INTER-AMERICAN HIGHWAY

PART I.—GENERAL INTRODUCTION AND PREFACES

BUREAU OF PUBLIC ROADS
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

GENERAL INTRODUCTION

The idea of an inter-American highway from the United States to Panama stirs the imagination. The route, starting at the Rio Grande, must traverse a group of republics which represent some of the earliest Spanish colonial settlements on the American Continent. The route will swing in a broad flat curve from the heights of the Mexican plateau to sea level on the adventurous coasts of the Spanish Main. It will cross the trails of conquistador, buccaneer, filibusterer, missionary, and settler, associated with all the romance and glamour of empire building on a magnificent plan, of sordid gold hunting, of human slavery, governmental inefficiency, and finally revolt, independence, and a slow and difficult struggle against the fortuitous events of an unkind history.

Although having physical contact along boundaries in large part artificial, the intense spirit of independence that sustained the Spanish colonies through an initial revolution for autonomy that lasted practically 20 years, has held the several states politically separate in spite of a common fatherland, a common language, common religious background, and the same national and racial traditions.

A slow but steady development has characterized all the Central American republics, although their developed wealth has not yet reached a point that has enabled them to provide for themselves those indispensable lines of communication that alone are capable of enabling their scattered populations to communicate with each other, overcome inaccessibility of agricultural and mineral resources, and the great distances that separate their national centers.

This continued and present lack of capital resources has undoubtedly had a marked effect on the political history of each of the republics. General isolation continued for decades created an attitude of aloofness, if not of suspicion; the lack of adequate transportation encouraged a sense of self-sufficiency even in the presence of inadequate resources; and the inability to develop exchange of commodities among themselves has acted to restrict the production of even those goods which might have furnished surpluses for trade with the adjacent republics.

The development of a new method of transportation, more flexible and less costly in the first instance than railroads, and the general awakening of opinion to the advantages of communication and human contact, have changed the situation in recent years.

This fact is clearly attested by the projection in every one of the seven republics between the United States and South America, of a highway program limited only by the financial resources of the several governments. In Mexico, Panama, El Salvador, and Costa Rica these projects have assumed large proportions during the last 10 years. In Mexico and Panama construction is continuing under well-organized central agencies. Progress of construction in those two countries has been notable and results of an economic nature no less so. The Mexican Government under a well-organized body of Mexican engineers has pushed construction on the route from Nuevo Laredo, on the Rio Grande, to Mexico City so rapidly that the total distance of approximately 800 miles (1,300 kilometers) will probably be opened to traffic at all seasons before the middle of 1935. Panama, through its efficient Junta Central de Caminos, has graded 310 miles (496 kilometers) from Panama City to David and has surfaced and largely oiled the road as far as Sona. The work in Costa Rica, although representing a smaller mileage, is generally of a higher type of construction because the sections built connect a series of important cities on the famous Meseta Central.

All of this work has gone far enough to disclose the possibility of continuous and connected construction. Two years ago traffic records indicated that an average of 2,000 vehicles visited Monterrey, Mexico, from the United States over each week-end and the trip was limited for a large fraction of this traffic only by the fact that the completed road did not invite further travel. In Panama the entire character of the towns along the Camino Central to the west of the capital has gradually changed as the improvement has advanced. In Chorrera, Chame, San Carlos, Penonome and beyond, municipal development has been notable as building construction has improved, public utilities increased, and the interchange of persons and goods has been facilitated.

The opening of the new ferry service across Balboa Basin in September 1932, during the course of the survey, has been attended by results little short of astonishing. This ferry line and the Thatcher Highway, extending to the boundary of the Canal Zone en route to Chorrera, are some 7 miles shorter than the old line by way of the Pedro Miguel Ferry and the road through Empire. In the first full year of operation the new ferries carried almost exactly 100 percent

more vehicles than were carried by the old ferry during its last year and the number of persons crossing the ferries increased approximately half a million.

In Costa Rica the fact that the main artery on the Meseta Central has had no adequate highway connection beyond the limits of that upland area has impressed the public mind with the need and the possible advantages of extension of connections into the lowlands and into other sections of the country.

Almost coincident with the organization of highway activities in these countries and in other republics in South America, the general topic of interrelated highway programs became a subject of official discussion before several international bodies. Beginning in 1923 at Santiago, Chile, a series of conferences, resolutions, and official visits of inspection and study followed, each advancing the matter more pointedly toward active field operations. A chronology of the several meetings and conferences and the action taken appear in appendix A to this report. These evidences of public opinion as displayed in local construction programs and in the broader form of common official action establish the opportunities of the present survey.

On March 4, 1929, the Congress of the United States passed a joint resolution (Public Resolution 104, 70th Cong.) authorizing the appropriation of funds for the proposed reconnaissance. Following this action and taking advantage of the opportune return through Panama of United States delegates to the Second Pan American Highway Conference just concluded at Rio Janeiro, the Republic of Panama invited the countries of Central America, Mexico, and the United States to send representatives to a conference at Panama City to consider ways and means of furthering the proposed plan for a survey between the Isthmus and the Rio Grande.

On October 7, 1929, this conference was held in the Palacio Nacional under the chairmanship of the Honorable Luis F. Clement, Secretary of Agriculture and Public Works of Panama. The following authorized representatives were present from Panama, Costa Rica, Nicaragua, Honduras, El Salvador, Guatemala, and the United States:

For Panama:

The Honorable Luis F. Clement, Secretary of Agriculture and Public Works.
Mr. Tomas Guardia, Ingeniero Jefe, Junta Central de Caminos.
Mr. Enrique Linares, Jr.
Mr. Jose R. Guizado.
Mr. Eduardo Icaza A.
Mr. Leopoldo Arosemena.
Mr. Macario Solis.
Mr. Rudolfo Herbruger.
Mr. S. Ernesto Duque.

For Costa Rica:

The Honorable Enrique Fonseca Zuniga, Minister to Panama.
Mr. Juan Matamoros.

For Nicaragua:

The Honorable Bernabe Portocarrero.

For Honduras:

Dr. Marcos E. Velasquez, Charge d'Affaires in Panama.

For El Salvador:

Mr. Manuel Lopez Harrison.

For Guatemala:

Mr. Eduardo Icaza (designate by letter).

For the United States:

Dr. J. G. South, Minister to Panama.

Mr. T. H. MacDonald, Chief of the Bureau of Public Roads.

Mr. J. W. Drake.

Mr. H. H. Rice.

Mr. E. W. James.

Mr. Pyke Johnson.

Mr. Karl Miller.

For the Canal Zone:

Maj. R. A. Wheeler, Engineer of Maintenance.

Mr. George W. Green, Municipal Engineer.

This group enthusiastically endorsed the proposed survey and took action calling on the several governments represented to furnish transportation, assistants, maps, existing survey records, and any other cooperation needed in carrying out the required field work.

In March 1931 a second conference was held, also at Panama, and the Inter-American Highway Commission was organized with Mr. Tomas Guardia, chief engineer of the Junta Central de Caminos of Panama, as chairman (appendix A). This organization was effected for the purpose of establishing a semiofficial group of representatives of the several countries to aid in the prosecution of the survey and to act as an advisory body before the several governments through the Pan American Union.

The membership of this Commission was eventually made up as follows:

For Panama:

Mr. Enrique Linares, Jr.

Mr. Tomas Guardia.

For Costa Rica:

Mr. Manuel Antonio Viquez.

Mr. Jacinto P. Arango.

For Nicaragua:

Dr. Mariano Gasteazoro.

For Honduras:

Dr. Marcos E. Velasquez.

For El Salvador:

Mr. Manuel Lopez Harrison.

For Guatemala:

Mr. Felix Castellanos B.

Mr. Gabriel Barrios.

For the United States:

Mr. T. H. MacDonald.

Mr. J. Walter Drake.

Mr. W. R. Ely.

Mr. Harry W. Chandler.

In the meantime and preliminary to any field work, a general study was made of the entire region to be traversed with special reference to its topography, meteorology and drainage. The geography, both political and economic, was examined in detail. Existing highways and railroads were especially considered and as a result a determination was made of the most

favorable route for further detailed study. Indications were clear that the Pacific side of the central mountain uplift should be followed except through those regions where the line would cross the high interior plateaus themselves. The Atlantic seaboard throughout Central America is the area where lie most of the swamp lands. In this region all available meteorological data indicate the rainfall, both for the year and for the months of the rainy season, is approximately twice that on the Pacific slope. Practically all the centers of population on the Atlantic side of the cordillera are seaports, served by shipping facilities, and devoted to localized export trade. The configuration of the coast is such that a line following closely the Caribbean shore would be greatly lengthened, and if not following the shore would of necessity miss much of the populated area. To follow the coast line would involve considerable area of swamp and marsh land and compel crossing the largest streams in every country at points not much removed from their mouths.

On the Pacific side there is practically no swamp or marsh land, the streams are short and largely intermittent in flow, and there are many old settlements in the interior but accessible to the coast and on the central uplands. Further, a general route along the Atlantic slope would have made it difficult or quite impossible by a reasonable line to have included the Republic of El Salvador which alone has only a Pacific coast line.

Further, the sum total of existing highway construction south of Mexico City clearly indicates that in the several countries the preferred line of intercommunication and internal development is along the Pacific slope or on the Pacific side of the mountain plateau. This clear expression of the requirements of local needs and of priority in the construction of lines of communication was conclusive in determining the general region to be examined in the reconnaissance.

It is to be noted that the same general line had been followed by the surveys for the Intercontinental Railway Commission, made about 1892, after similar studies of the general terrain and its prevailing characteristics.

It is possible that the route along the Pacific slope is longer than one that might have been located along the Caribbean seaboard, provided the coast were not followed around the peninsulas of Honduras and Yucatan. But the amount of construction will be distinctly less along the route selected because it was made one of the essential specifications of the reconnaissance that so far as possible use should be made of all existing highways, even though the resulting line were somewhat indirect and longer.

Throughout the reconnaissance every effort has been made to give consideration to this recommendation and a special point has been made of utilizing the advantages and developing the possibilities inherent in all the existing work of the several countries. Their

location of principal routes has indicated at many points the general line of the survey. Their initial construction has definitely determined more detailed location over many miles of highway and in Panama, Costa Rica, Nicaragua, El Salvador, Guatemala, and Mexico a considerable mileage of completed highway already exists as a part of the projected line. (See table 1 of the Technical Preface.)

Reference to the economic sections of the report will disclose how entirely justifiable the general route is, reaching as it does a large percent of the population in major centers and serving provinces that already by their development require additional means of communication.

Following the passage of the act of Congress (Public, No. 78, 71st Cong., approved Mar. 26, 1930) appropriating funds for the survey of a route to connect North and South America and the completion of preliminary studies, a party was organized for field work and arrangements were made in June 1930 for establishing headquarters at Panama. Through the courtesy and generosity of the Panamanian Government space for offices and drafting quarters was provided through the Junta Central de Caminos in the Palacio Nacional in Panama City. These quarters were occupied, rent free, until the conclusion of the field work in Central America in May 1933.

Applications for survey in accordance with the law were made through the Pan American Union for the several republics as follows: Guatemala, April 6, 1929; Nicaragua, June 11, 1929; Panama, July 14, 1930; Honduras, September 3, 1930; and Costa Rica, February 24, 1931.

Although the formal application of the Panamanian Government was not made until July 1930, adherence to the general plan was officially indicated in the June preceding when that government offered space for general offices and headquarters.

The Republic of El Salvador was about to make request for survey when a change of administration occurred which lasted during the period of the field work. The Departamento de Fomento and the officials of the engineering staff of the government extended every possible assistance in connection with the study, by furnishing plans and records of surveys already made, and by cooperating in determining the common points of meeting at the boundaries of Honduras and Guatemala; but in the absence of an official request for cooperation under the law, through the Pan American Union as required, actual field operations and the assuming of financial obligations for a survey in El Salvador were impossible.

The Government of Mexico by letter advised that their surveys and plans for the system of national highways contemplated a route from Nuevo Laredo at the boundary of the United States to a point on or near the Rio Suchiate at the Guatemalan boundary,

and that this route would constitute the section of a feasible inter-American highway through that republic. It was further stated that the Mexican Government expected to continue surveys and actual construction as rapidly as funds became available. For this reason it was considered unnecessary and was actually impossible under the act of Congress to carry the reconnaissance beyond the Guatemalan boundary with Mexico.

Considerable difficulty was experienced in finding adequate maps of the territory to be reconnoitered and finally it became necessary to resort to aerial photographs and the compilation of mosaics as a basis for plotting the general line. For this work the cooperation of the United States War Department and of the Department of the Interior was sought. The Army Air Corps operating out of France Field, Canal Zone, and the Geological Survey lent invaluable assistance with their experienced personnel and equipment in this connection. The airplane photographs were not used especially for initial location work inasmuch as little or none of the area traversed was entirely unknown. It was generally possible by inquiry of the engineering and other authorities in the several countries to secure sufficiently reliable information regarding the existing trails, low passes, river conditions, and other necessary details to determine possible alternate routes worthy of study. Explorations were then made with pack train or on foot to enable the engineers of the survey to locate the most feasible line. Control points were then indicated to the air force and in some cases markers of white cloth were staked out on the ground so disposed as to enable the observers to fly the route and photograph a strip sufficiently wide for further detailed study and mapping purposes.

No predetermined or uniform fixed procedure was possible in making the survey, and various methods were employed suited in each instance to the conditions met. Where maps were available and passable wagon roads existed, the odometer or scaling was used to determine distances. Occasional resort was had to stadia measurements, and in sections where the several national highway authorities had made preliminary or final surveys these were always freely made available by the respective authorities. Elevations were generally determined by aneroid, checked against past records. The reports of the Intercontinental Railway Commission which operated through the same general territory in 1891 to 1893 were found to be a valuable aid at many points, especially in checking elevations.

The entire line was traveled by some member of the engineering staff and the contiguous ground thoroughly reconnoitered.

The general procedure was for the engineer in charge of field work to make contact with the local national authorities through the United States diplomatic missions in the several countries, and then to consult

the highway officials and arrange the necessary details of the surveys. Every possible assistance was afforded in every country, usually through the highway commissions or equivalent officials in securing guides, laborers, pack animals, and supplies. In practically all cases local engineers familiar with at least parts of the projected route were assigned to accompany the field parties on the survey and in some cases, where motor transport was practicable, official cars or trucks were furnished by the local officials. In all cases the point of meeting at national frontiers was agreed to by engineers representing the countries concerned; in several instances engineers of both adjacent countries and the engineers of the survey met at the boundary and agreed upon a satisfactory and acceptable common point of the survey.

The calendar of progress is indicated in appendix B attached to the report.

Attention to the technical and economic sections of the report for each of the several countries will disclose that every effort has been made to utilize the actual construction and the projected roads already accomplished or planned and to carry the line into areas which promise large opportunities for future development. Conspicuous instances of the former circumstance are found in the Camino Central of Panama, the constructed sections of modern highway on the Meseta Central in Costa Rica, the line of the longitudinal road in El Salvador, for which surveys had already been practically completed, the constructed sections in El Salvador, the existing main wagon road in Guatemala, and the Carretera del Sur in Honduras. The capitals of all countries are reached, all but one being on the main route. Examples of areas promising especial future development are the Chiriqui Plateau in Panama, the Sabana de Limon, the El General Valley, and the Guanacaste Plains in Costa Rica. Throughout its entire course the route is planned to furnish an excellent trunk line from which a general national highway system may be projected in each country and contacts are made so far as practicable with existing rail lines and maritime ports.

This report considers each country as a separate unit, beginning with Panama. For each country there is a description of the principal economic features and conditions, a detailed account of the surveyed location and controlling conditions existing along it, with reasons for the rejection of promising alternates where such were encountered, a strip map of the line with plat and profile with a full presentation of control points needed to guide future operations on location and construction surveys, and a series of photographic mosaics in which the line is laid.¹

¹ The mosaics accompany the 5 original copies of the report, but owing to their bulk and cost are not reproduced in the printed copies, nor are they available for distribution. A sample reproduction of a section or bellows on a reduced scale appears with the report as printed.

The general account is preceded by a statement of the bases of the estimates and the proposed sequence of construction. The estimates are based so nearly as possible on conditions current during the most recent construction activities and are believed to represent a fair valuation of the probable total cost of the project in accordance with the respective types of construction.

The economic sections of the report describe the countries briefly and furnish data to show the national wealth and income so far as these may be determined, the status of the national debt, the production of principal commodities and their value and distribution, commodities entering into international trade and the chief ports of entry and shipment, the existing highway and railroad systems, and the organization and functioning of the highway administrations. The possibilities are indicated of further highway construction based on the projected route as a nucleus, and of opportunities that would immediately follow construction for developing highway transport. The extent and distribution of public lands as a possible support to construction cost and as an index of future development are touched upon so far as existing meager data permit.

The technical and economic prefaces cover in summary form the basic facts developed by the survey, including estimates of cost of construction.

The act providing for the survey, involving as it did contacts and negotiations with foreign governments, was under the administrative control of the State Department and by arrangement with the Department of Agriculture the Bureau of Public Roads was called upon to cooperate with the State Department by conducting the reconnaissance. The Bureau was to furnish engineers and to supervise the work. The State Department was to make official contacts in the premises and arrange for the active cooperation by those countries making application through the Pan American Union.

Under this arrangement the Bureau started operations in Panama, Nicaragua, Honduras, and Guatemala, the project being in charge of Mr. E. W. James, Chief of the Division of Highway Transport. The office which was opened in Panama was in charge of Mr. Thomas A. Forbes, senior highway engineer, and Mr. D. Tucker Brown, senior highway engineer, was in charge of field work assisted by Mr. Marcel J. Bussard, assistant highway engineer.

After initial contacts had been made with the governments of the several countries it was agreed by the State Department and the Department of Agriculture that the work could be expedited by conferring a wider freedom of action upon the Bureau of Public Roads, and on February 24, 1931, a memorandum agreement to this effect was entered into. By December of that year the work had so far advanced that a separate office force in Panama was not considered longer necessary and changes in personnel were made, placing Mr. D. Tucker Brown in charge of all field operations and of the Panama office, with Mr. John K. Flick as assistant. It was becoming apparent that sufficient local assistance in the field was available, both as to personnel and outfits, to make it desirable to depend upon local engineers and to reduce the number of engineers assigned from Washington. Mr. Forbes and Mr. Bussard were recalled at this time.

The work moved rapidly forward during 1932 and 1933. Dr. George Curtis Peck, United States commercial attaché first at Panama and later at Guatemala City, was assigned by the Department of Commerce to accompany the engineers and to assemble economic data relating especially to the highway throughout the Central American republics.

By May 1933 the field work was complete, airplane views had been finished for mapping purposes, economic data had been largely gathered, and active work was started on the report.

The air force of the War Department at France Field furnished the first prints and mosaics resulting from the airplane views, the services of the Geological Survey were enlisted in mounting the prints, and valuable aid was given by the military attaché in Costa Rica and by the Marine Corps in Nicaragua. About July 1, 1933, the Panama force was recalled to Washington where the completion of drawings and report was carried on actively until December 1933. The preparation of the report as well as the conduct of the survey has been under the general direction of Mr. E. W. James. Mr. D. Tucker Brown has prepared the technical sections and been in charge of draughting and photographic mosaics. Dr. George Curtis Peck has prepared the economic sections, using data assembled personally in the field and available material from the files of the Bureau of Foreign and Domestic Commerce of the Department of Commerce. Mr. H. H. Kelly of the Division of Highway Transport has been responsible for assembling the report and has furnished valuable editorial assistance.

ECONOMIC PREFACE

One of the unique advantages of the North American Continent is that it embraces both the Temperate and the Tropical Zones, and that between the two there are no mountain or water barriers such as exist in other parts of the Northern Hemisphere. The highly developed areas of the north and central portions of the continent are contiguous to the potentially rich but less-developed areas of the south, and direct overland communication between them is feasible.

This is the basic economic fact presented by the proposed inter-American highway. To perfect the connection between these two complementary regions, whose products are so susceptible to exchange for the reciprocal benefit of their peoples, only highway transportation is lacking. With road connections established, the resultant benefits in exchange of goods, in development of natural resources, in growth of tourist traffic, in higher standards of living in areas hitherto barred from economic progress by lack of communication, and in interchange of ideas and international amity, appear manifest.

The Tropic of Cancer passes through the Republic of Mexico a few hundred miles south of the United States border. Below that line a new world opens to the traveler and the business man from the north. Here are the outpourings of a prodigal nature, profuse and varied. The names of some of them are synonymous with the highest excellence: The Chorchica chocolate of Panama, the coffee of Costa Rica, the pita fiber of Nicaragua, the mahogany of Honduras, the Peruvian balsam of El Salvador, the honey of Guatemala—not to mention such staples as corn, beans, and many textile plants. And to the traveler and business man from the south, leaving the Tropic Zone, there opens the vista of the highly industrialized areas of the north, with a wealth of manufactured and other products complementary to his own.

Central America is a land of contrasts. Mountain plateaus rise from tropic lowlands. Large cities adjoin vast areas of low population but great potential productivity. Descendants of the men of Europe and the progeny of the aboriginal Indian natives are fellow citizens. Here is a field made for commerce and agriculture and the flowering of the human spirit, and all that has been lacking to make it more fruitful is an adequate means of communication.

Despite the proven potentialities for wide diversification of products, concentration of effort upon coffee and bananas is still the outstanding character-

istic of Central American agriculture. These two commodities comprise over 90 percent by value of the aggregate exports of the six republics. Crop failures or unprofitable prices affecting coffee and bananas rend the entire economic fabric of these countries. Yet there is no reason to doubt that there are many agricultural products now grown haphazardly, experimentally, or not at all, which would flourish in these regions of varied soils and climates. Once these fertile lands are penetrated by highways it will become worth while for the scientific and hard-working agriculturist, moderately capitalized, to coax them into yielding abundant and diversified harvests.

As related to the economic interests of the United States these potentialities should weigh heavily in estimating the ultimate value of the inter-American highway. This highway has been thought of as an automotive sales outlet, as a tourist attraction, and as a trade-in-general stimulator. It would be all of these, no doubt. And it would probably do more to create cordial relations and brisk exchange, not only between the peoples of Central America and Mexico and the United States, but also among the Central American and Mexican inhabitants themselves, than would all the diplomacy and "good-will" visits that could ever be devised. As a missionary, a highway has no equal. Good roads make for good neighborliness.

But the possibilities do not end here. Throughout a very long period of our international trade we have been dependent upon the Far East and the Antipodes for many commodities which we do not produce at all, or produce in quantities insufficient for domestic requirements. Among these may be mentioned hard rice, tea, cinnamon, and other spices and condiments, camphor, quinine, and other medicinals and drugs, rubber, copra, many palm-nut and vegetable and essential oils, varnish gums such as copal, wool, abaca hemp, and insecticide plants.

There is good evidence to show that all the commodities mentioned above and many others can, with the application of sufficient capital and scientific methods, be produced in large volume in Central America. Although these countries, and the Caribbean region in general, have been regarded as high-production-cost areas, the cause of this is traceable primarily to lack of cheap transportation, and not to any inherent difficulties of resources or manpower. Adequate highway systems connecting with

present short water hauls will do much to remedy existing deficiencies. These considerations, of course, apply chiefly to agriculture, which will doubtless be the dominant characteristic of this region for centuries to come; yet they have significance also in respect to lumbering, with vast hardwood forests thus far undeveloped, and to mining, with mineral resources whose extent is still undetermined.

As this is being written, an announcement is made public that Sierra Leone, West Africa, has placed an embargo on copal gum export for 1 year, dating from January 1, 1934.

What could be more prescient than to encourage, induce, and expand the production of these commodities, many of them basic, in the Central American countries, engender versatility in agriculture, and abandon the one-crop status? The consummation of such a program would insure a far more equitable and generous distribution of wealth among the Central American inhabitants than they have heretofore experienced, and would raise their standards of living to a salutary level.

Today thousands upon thousands of tropical and temperate acres lie uncleared and idle, due partly to lack of initiative and capital, partly to specialization in coffee and bananas, and partly, perhaps chiefly, to their inaccessibility. Reference to the details presented in the several economic sections following will disclose the areas and their possibilities that today remain open to settlement. In Central America as a whole the total of such lands amounts to many millions of acres.

It seems certain that Brazilian competition is sounding the death knell of low-grown Central American coffees and the nemesis of the banana, the banana wilt, may eventually eradicate that fruit as an appreciable factor in Central American export trade. In recent years poor coffee prices have impressed on the Central American growers the fallacy of leaning so heavily on a single crop, and they are eager to cooperate in any movement which contemplates the raising of other crops, the restoration of their cultivated lands to profitable employment, and the development of their idle acres. Lands made available by these changes will afford further opportunity for development by colonization and diversification of products.

That the Central American countries sense the need of immigrant colonists is shown by the several attempts made in the past few years to bring them in. "We need to populate," declares the *Diario de Costa Rica* (San Jose, Nov. 7, 1933). "We need new blood and strong arms for the development we must have in the future; strong men from all the world, competent for agriculture of all kinds, should come to enrich our blood and our soil. And this should take place at once, whilst the great highway is penetrating the country." Lack of colonization, together with

internal isolation, has operated to retain old and primitive methods of Spanish colonial days in agriculture, in the handicrafts, in preparing goods for market, and, most seriously of all, in methods of transportation.

That the inter-American highway will create an irresistible urge for lateral roads which will throw open the potentially rich agricultural regions of Central America is amply attested by the subsidiary road development which is following Panama's extension of its national highway toward the Costa Rican frontier, and in some measure by the development from Guatemala's national highway of pioneer roads into a few of its hitherto inaccessible lands.

Considering the contributions of the Central American republics in making the reconnaissance survey, the utterances of their public men, and the continuing propaganda of the Central American press in favor of the project, there is every indication that the peoples of those countries are at present in the mood and of the mind to accept the cooperation and assistance of the United States in completing the survey and constructing the inter-American highway.

One of the collateral benefits of the proposed highway would be its value in serving as a ground line to guide air service, to aid in the location of airports, and to connect with emergency landing fields.

During the past few years the governments of the Central American republics² have recorded real progress in, and growing appreciation of, the value of statistical data—more detailed censuses, chattel inventories, agricultural production, trade and ship movements, construction progress, government accountancy, and the like—and commendable efforts have been, and are being adopted, to obtain accurate figures under these categories from which economic appraisals may be made. Where domestic activities and developments can be localized the resultant statistical data are on the whole acceptable, but unfortunately the plans of these small nations are discouragingly circumscribed by lack of the very thing which the proposed inter-American highway should go far toward bringing to realization, namely, an adequate system of vehicular roads.

There are at present large areas in each of the Central American countries so inaccessible that little is known of their actual or potential resources, hence resort is frequently had to hearsay or guesswork.

Such a situation makes difficult the preparation of intensive economic studies covering the Central American states, and frequent consultation of material in United States Government files has been necessary. In the studies which follow, available statistics have been supplemented by personal observations and acquaintanceship and by statements of men of experi-

² Up to 1903, when Panama achieved its independence, it was not included in the tier of states embraced in the expression "Central America." Nor does it so consider itself today, for that matter. Nevertheless, for the purposes and convenience of these economic studies, it is assimilated with the Central American republics.

ence in the regions or subjects whereof they have spoken. The best that could be done has been done.

It will be noted, in considering the detailed statistics on foreign trade included in the section on each country hereinafter, that the world depression has been felt in Central America in about the same measure as in the United States. Figures for the peak years 1928 to 1930 are particularly interesting as showing the levels which these nations have attained in the past and which they will doubtless reach again and exceed. It should be said that the foreign trade statistics are from official governmental sources and show the visible trade balances, the so-called "invisible" items not being available.

To name all those to whom credit is due for assistance in the preparation of these studies would necessitate the typing of a very long list. Deserving of

particular mention are the various governmental agencies of the respective Central American republics which have assisted to the fullest extent within their power, as have also the diplomatic and consular officers of the United States assigned to Central America. Europeans, Americans, and Nationals of prominence and good standing, resident in the countries, have made generous contributions of their time and knowledge of local conditions. The Latin American division of the State Department and the regional information, finance, and automotive divisions of the Bureau of Foreign and Domestic Commerce, Department of Commerce, have given splendid cooperation. The still unpublished material prepared by Commercial Attaché Merwin L. Bohan for a Handbook of Guatemala merits special citation and has been freely used in preparing the study of Guatemala.

TECHNICAL PREFACE

Reconnaissance surveys consist of the examination and investigation of terrain with a view to determining the most feasible locality over which later and more detailed surveys should be made for the ultimate location of a projected enterprise. The results of such surveys should show an approximate cost of the contemplated project and give its location in sufficient detail to guide later activities. The methods employed and the instruments used depend largely upon the territory to be examined, the necessity for detail work, and the desired accuracy of the estimated cost.

The project under consideration at present necessitated the examination of about 190,000 square miles (492,000 square kilometers) of territory lying in the western part of the Republic of Panama and in the Republics of Costa Rica, Nicaragua, Honduras, and Guatemala. No reconnaissance was undertaken in El Salvador or Mexico, and the data included that relates to these republics have been secured from existing maps and various officials of those countries.

A large part of this territory was reconnoitered only in sufficient detail to determine whether the general route of the highway should be along the Atlantic or Pacific littoral, in whole or in part, or along the Continental Divide, in whole or in combination with one or both of the littorals. After conferences with Government officials, examination of existing maps, study of meteorological data, and the investigation of a limited amount of terrain, it was decided that the Pacific littoral, in combination with the Continental Divide, offers the more feasible route.

This is evidenced largely by existing conditions which show that the larger cities and more densely populated areas are along the Pacific slopes and on the Continental Divide. Also, practically all the efforts of the republics concerned toward the construction of modern and continuous highways have taken place in the territory selected for the inter-American reconnaissance. One of the principal reasons for the development of the Pacific littoral and the Continental Divide in preference to the Atlantic side may be found in the fact that the rain on the Atlantic side is practically double that on the Pacific side.

This decision eliminated a vast territory from more detailed reconnoitering, and the problem resolved itself into defining a route through the selected territory in sufficient detail to guide future surveys and activities.

The Pacific slope of the Continental Divide comprises terrain with varied topographical features, ranging from the flat coastal plains to the rugged and in many instances precipitous spurs that jut out from the Continental Divide and hold between them many streams of turbulent nature. It is almost devoid of vegetation in many areas, while in others there occurs luxuriant and in some instances almost impenetrable jungle and forest growth.

Through these ever-changing natural conditions the reconnaissance was carried by the most practical means at hand. These consisted of movements on foot, on horseback, by boat, and by automobile; observations on the ground and from the air; and accumulation of data from records, maps, instrumental surveys, and investigations.

Two photographic planes from the Army Air Corps cooperated with the ground forces. Their flights were directed and controlled by previous observations and investigations that had been made in the field.

The results of the aerial surveys are presented in this report in the form of mosaics mounted in bellowsed strips. Upon these are shown in black the proposed route with distances in miles and kilometers from Panama and the names of the principal streams and centers of population.

There are 90 mosaics³ of varying lengths, distributed as follows: Panama, 30; Costa Rica, 28; Nicaragua, 9; Honduras, 7; Guatemala, 16.

Their scales vary according to the difference in elevation between the plane and the territory being photographed. There are no mosaics for El Salvador.

Plan and profile maps of the entire line (excluding Mexico) are shown to the approximate scales of 1 inch equals 10,000 feet horizontal and 1 inch equals 1,000 feet vertical. The line as shown on these maps is identical with that shown on the picture mosaics, except that it is to a different scale. The elevations on the profiles are largely conjectural and based on sketching, except at principal control points, where they have been accurately determined by aneroid.

There are 46 plan and profile sheets of varying lengths, distributed as follows: Panama, 13; Costa Rica, 10; Nicaragua, 6; Honduras, 3; El Salvador, 5; Guatemala, 9.

In addition to the aerial mosaics and the plan and profile sheets, there are included a map of Mexico, the

³ These mosaics appear only in the 5 original copies of the report and are not available for distribution.

Central American republics, and Panama, together, and a map of each of the individual republics (excluding Mexico).

In the set of plan and profile sheets for each country there is inserted the last sheet of the preceding country and the first sheet of the following country.

On the plan and profile sheets the mosaics are referred to by roman numerals and the area covered by each mosaic is that framed by lines on the plan and profile sheets.

The policy followed throughout was to utilize the existing road when possible as a basis for the reconnaissance line. Alternate routes, revisions, and slight deviations from the existing road where it was used as the basis for the reconnaissance are fully discussed in the text. This obviates the introduction of numerous alternate lines and revisions on the plan and profile sheets and on the aerial mosaics. Such procedure was not practical, however, over large sections of line in Costa Rica, Nicaragua, Honduras, and El Salvador, but was used almost entirely throughout Panama and Guatemala, where more road work has been accomplished than in the other republics.

The line as shown on the maps and mosaics is typically a reconnoitered line and is in no sense a location. It is the line that should guide future surveys and be approached by them as nearly as physical features and standards will permit without exceeding the allowable cost.

The project is entirely feasible from an engineering point of view, although it will require in many places the exercise of experience and a nice skill for the final determination of the most practical and economical location, and being through tropical countries it will embody problems that seldom, if ever, arise in temperate climates.

RECOMMENDED CONSTRUCTION STANDARDS

Alinement.—Considering the terrain through which the reconnaissance survey was made, it is recommended that the ultimate minimum radius of curvature be limited to 164 feet (50 meters).

Grades.—The ultimate maximum grade should not exceed 7 percent. When it becomes necessary to use grades near the maximum it is very important that the side ditches be relieved of water at intervals of not more than 300 feet (92 meters).

A minimum gradient of 1 percent is recommended when the general contour of the ground is being closely followed. In places where the roadbed is entirely on fill and the surface water can be drained to both sides, it is not objectionable to have a level gradient.

Graded section and surfacing.—The report contemplates the consideration of three alternate types of road surfacing: One to be constructed by the use of any satisfactory local material, another to be constructed of the same materials with an oil treatment,

and one to be constructed of concrete. These are shown as types 1, 2, and 3 in the section on estimates of cost for each country. The first two types are to be 18 feet wide with a graded roadbed 28 feet between ditches except where the road is already constructed. The last is to be 20 feet wide with a graded roadbed 32 feet between ditches.

Drainage.—Drainage structures should have a minimum clear traffic-way of 20 feet, and be designed for modern truck traffic. The larger structures should be steel superstructure with masonry or concrete substructure. Smaller structures should be of masonry or concrete, the choice of which will depend largely upon the materials available at the site. Culverts should be of either concrete, masonry, or portable sections, the selection of which will be governed largely by the accessibility of the location.

The above standards are taken into consideration in the estimates of cost that follow. The estimates do not include any item for purchase of right-of-way as it is contemplated that this will be provided for by organic law in each country.

General remarks and suggestions.—Although the standards of line, grade, and drainage structures as recommended should be the ultimate goal it is possible that they may not be attained in the original opening of the road. The strict adherence to them would prove costly in many places and funds may not be available. At such places it is justifiable, for economy in the original opening of the road, to decrease the radii of curves, but in such a way that the standard minimum radii can ultimately be obtained without exceeding the maximum gradients. This is particularly applicable in mountainous sections where it will be frequently necessary to use maximum grades, some of which will be of considerable length. Should the employment of small radii curves become unavoidable, provision should be made for ample sight distance by removal of timber, flattening of slopes, and widening of the roadbed.

The same principle applies to excessive gradients as to short-radius curves. If they are used temporarily, provision should be made for their reduction without having to resort to poor alinement in order to secure distance.

Tangents are recommended wherever practical, but are not advised if they throw the line into level terrain when slight curvature would give a location through gently rolling country, admitting the use of undulating grade lines and a road easily drained.

The above suggestions contemplate that the road will be opened for vehicular traffic with a minimum amount of work and the attainment of the ultimate fixed standards through gradual improvement over a period of time. The elapsed period between the time when the road first becomes usable and when it has been brought to the final standards will depend upon

the demands of increased traffic and the funds available for improvement.

If it becomes necessary to proceed as above outlined, it will be found that there are sections of the road which on account of the materials encountered during the grading operations will be serviceable throughout the year. These sections may be left for further improvement in the future while other sections are being brought up to a similar or even better standard. Through such a process of gradual improvement the cost can be distributed over almost any desired period of time. Previous to the application of higher types of surfacing from time to time, the alinement and grades of the section upon which they may be placed should be brought to the original design standard.

If a method of stage construction has to be resorted to, the original bridges may be constructed of timber superstructure and masonry substructure. There are in most localities many woods of satisfactory quality available. It is understood that some of them resist the ravages of insects and will remain in sound condition for 10 or 15 years.

The streams in regions having distinct wet and dry seasons are usually subject to rapid risings during the rainy season and since the formations of their banks usually consist of sand and loam interspersed with gravel or boulders, it is of the utmost importance that bridge sites be carefully selected. It is not unusual to see a rather large stream change its channel several times during one rainy season.

Freshets are usually of short duration, a fact that is particularly true in the upper reaches of the streams, but they reach high velocities and usually carry with them much debris and not infrequently, boulders of considerable size.

It is believed that in regions in which there is such intensive rainfall for short periods of time the policy should be adopted, where economically possible, of having an undulating grade line rather than a uniform one which makes it necessary to carry water for some distances in side ditches and exposes the road to the ravages of water flowing longitudinally along it.

There are so many varieties and classes of materials along the route that it would be impossible to give suggestions as to which to use in any particular instance without first having made a thorough study of them. It is believed that at almost every point on the line some satisfactory material can be had and it is recommended that the decision affecting this particular item be entrusted to someone at the time locations are made who has a thorough knowledge of local materials and who can indicate the best available.

Suggested cross sections for the contemplated types are shown.

Since there is no alternate freezing and thawing in the Tropics, it will be found that there are many classes of material that will stand with practically vertical slopes. In fact many instances were recorded where existing slopes have become concave toward the center line of the road.

Within a short time a growth has sprung up on the original surface near its intersection with the cut slope and by overhanging like the eaves of a roof prevents a great deal of wash by diverting rain water from falling directly on the slope.

Fills are frequently protected from wash by planting along them a shrub called "pinuela" which also serves as a protection for traffic.

Fences are easily constructed by setting out branches of several kinds of trees that take root and grow rapidly.

Table 1 gives the distances along the proposed highway from Panama to Texas.

Table 2 gives the summarized estimate of cost of the highway from Panama to Guatemala, inclusive.

TABLE 1.—Distances on inter-American highway from Panama City, Panama, to Nuevo Laredo, N. L., Mexico ¹

Country	Status of road					Totals	
	All weather	Good or fair in dry weather	Passable in dry weather	Trail	Under construction ²		
	Miles	Miles	Miles	Miles	Miles	Miles	Kilo-meters
Panama.....	250.0	92.3	-----	24.8	58.1	367.1	590.8
Costa Rica.....	43.6	28.7	122.1	161.9	-----	356.3	573.4
Nicaragua.....	-----	32.6	157.9	23.5	-----	214.0	344.4
Honduras.....	7.5	79.9	-----	-----	13.0	87.4	140.6
El Salvador.....	94.6	88.6	-----	-----	-----	183.2	294.8
Guatemala.....	118.4	192.0	-----	-----	-----	310.4	499.5
Mexico.....	751.3	377.7	254.9	344.4	191.0	1,728.3	2,781.3
Total.....	1,265.4	891.8	534.9	554.6	262.1	3,246.7	5,224.8

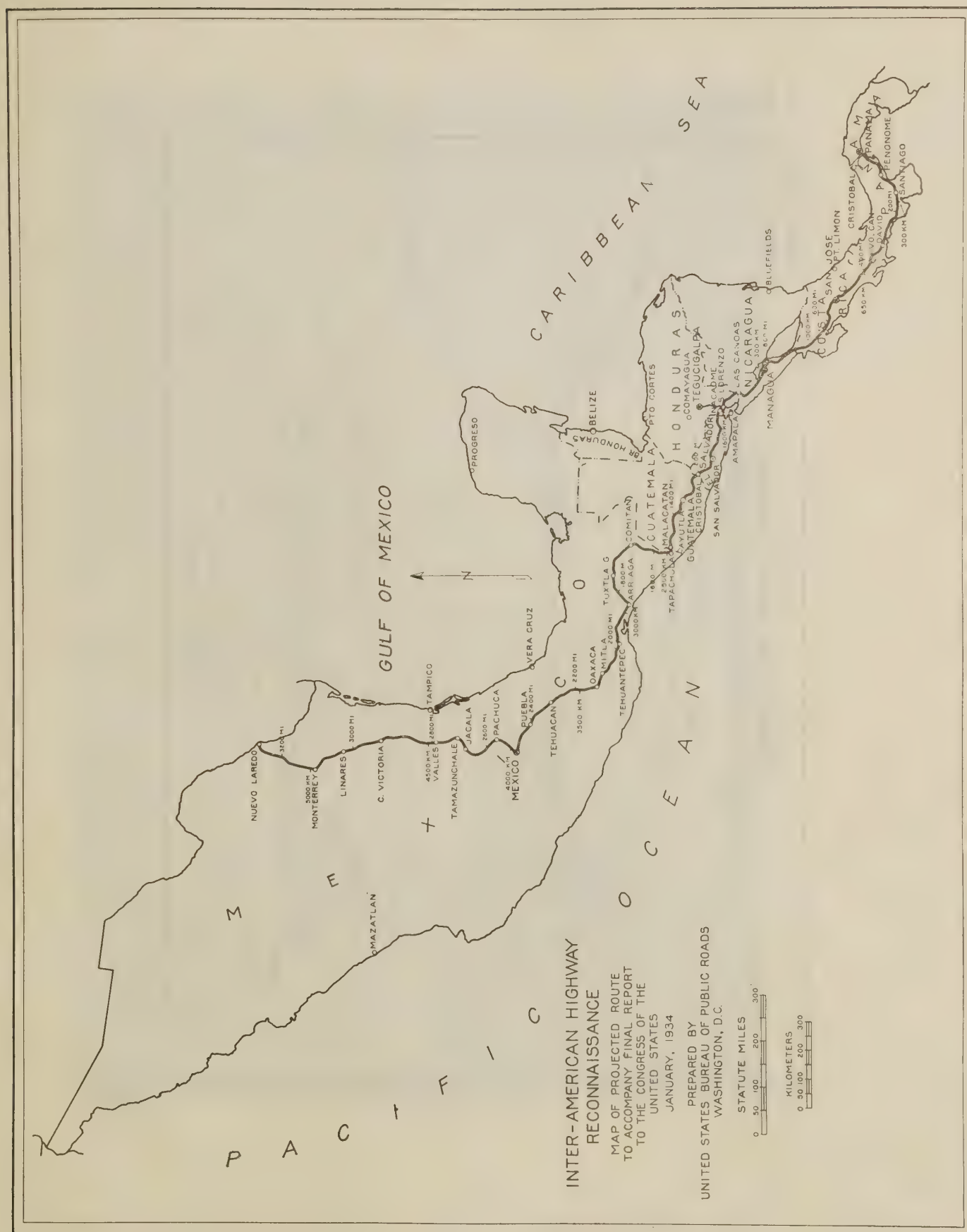
¹ Nuevo Laredo, Mexico, is opposite Laredo, Tex., on the Rio Grande.

² Items in this column are included in the other columns.

TABLE 2.—Consolidated estimate of cost ¹

Country	Length of road		Type 1	Type 2	Type 3
	Miles	Kilo-meters			
Panama.....	367.1	590.8	\$2,141,260.00	\$6,420,043.96	\$19,407,832.50
Costa Rica.....	356.3	573.4	11,145,206.25	11,516,693.85	25,907,156.00
Nicaragua.....	214.0	344.4	5,869,546.87	6,187,336.87	14,314,089.90
Honduras.....	87.4	140.6	2,267,493.75	2,785,987.12	9,711,130.00
El Salvador.....	183.2	294.8	2,344,117.50	3,111,367.50	9,990,200.00
Guatemala.....	310.4	499.5	6,641,730.00	7,624,392.75	22,030,800.00
Total.....	1,518.4	2,443.5	30,409,354.37	37,645,822.05	101,361,208.40

¹ The mileage to be built in Mexico, and not already provided for by the Mexican Government, approximates 786 miles. No survey was made of this section of the route and details cannot be furnished. Basing the probable cost of the Mexican section remaining to be done on the cost of construction in similar terrain actually surveyed in this reconnaissance, the costs for the 3 types of construction will be approximately as follows, in Mexico: Type 1, \$24,800,000; type 2, \$25,400,000; type 3, \$57,700,000. The total approximate cost to construct the entire route complete from Panama to the boundary of the United States at Laredo, excluding work now in progress in Mexico, will, therefore, be as follows: Type 1, \$55,200,000; type 2, \$63,050,000; type 3, \$159,060,000.

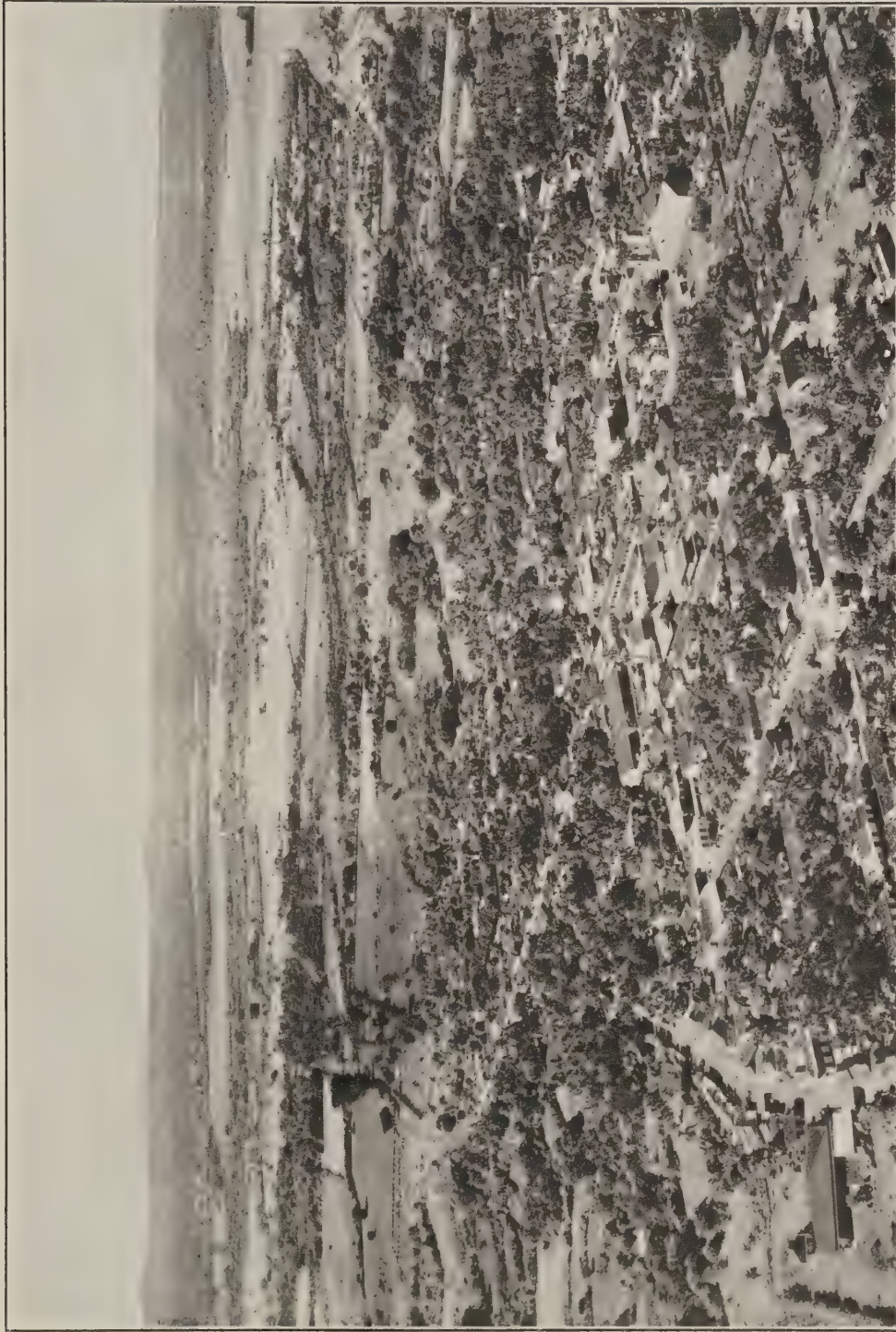




THE SOUTHERN TERMINUS OF THE PROPOSED INTER-AMERICAN HIGHWAY. AIRPLANE VIEW OF PANAMA CITY, REPUBLIC OF PANAMA.



SECTION OF THE CENTRAL HIGHWAY OF PANAMA, INCLUDED IN THE PROPOSED ROUTE OF THE INTER-AMERICAN HIGHWAY.
Typical road surfacing and bridge structure, in the region of the Rio Coton, between San Carlos and Anton. All of the construction work on this Central Highway has been performed under the initiative of the Government of the Republic of Panama.



THE CITY OF DAVID, 300 MILES WEST OF PANAMA CITY, LOCATED ON FERTILE PLAINS BORDERING THE PACIFIC OCEAN, WHICH CAN BE SEEN IN THE DISTANCE.
Here ends the Panama section of the inter-American highway now open to motor traffic practically throughout the year. It is rapidly nearing completion as an all-weather road. Sixty miles beyond, to the northwest, lies the Costa Rican boundary, and more than half of this distance is already traversable by automobiles in the dry season.



SPECIMEN OF FALLEN TIMBER NEAR EL JARDIN, COSTA RICA.

This is white oak and is said to have lain on this spot for 8 years, showing high resistance to the inroads of tropical insects and changes of climate. This general region along the Continental Divide contains hundreds of square miles of forests of hardwoods and conifers.



A STREET IN SAN JOSE, COSTA RICA.

Bus routes radiate from San Jose to towns lying within a radius of 30 miles. Automobile service is possible to even greater distances.



TYPICAL SECTION OF THE ROAD FROM SAN JOSE TO NARANJO, A TOTAL DISTANCE OF ABOUT 30 MILES.



PERMANENT BRIDGE OF REINFORCED CONCRETE OVER THE RIO COLORADO ON THE ROAD BETWEEN SAN JOSE AND NARANJO.



THE WESTERN SHORE OF THE BEAUTIFUL LAKE NICARAGUA.

This is said to be the only fresh-water lake in the world where tarpon is found. It is navigable for medium-sized vessels and, through the San Juan River, has a direct connection with the Atlantic Ocean for craft of light draft.



THE TOWN PLAZA IN DIRIAMBA WHERE FREQUENT BAND CONCERTS ARE CENTERS OF ATTRACTION FOR THE TOWNSPEOPLE AND VISITORS.

Similar public parks are found in all important towns.



SUN-DRYING COFFEE AT SANTA TERESA.

Coffee beans are contained in a fruit resembling a cherry. At the "beneficio" (processing mill) the "cherries" are pulped and washed, the inner skin (pergamino) is removed, and the grains are spread in the drying-yard (patio). After drying they are sacked and shipped. Some coffee is exported in pergamino.



CORINTO, PRINCIPAL SEAPORT OF NICARAGUA ON THE PACIFIC OCEAN.

Ocean-going vessels have good docking facilities at this port.



THE SECTION OF THE INTER-AMERICAN HIGHWAY IN HONDURAS IS THE SHORTEST IN ANY OF THE SIX REPUBLICS (ABOUT 90 MILES). This photograph shows the road now under construction on the southern part of the highway between Choluteca and Pavana. The former is the chief center of a region noted for its cattle and dairy products.



IT IS CUSTOMARY IN HONDURAS TO LET THE GRADING, DRAINAGE, AND SURFACING CONTRACTS TO NATIVE FOREMEN AT SO MUCH PER LINEAR METER.

Here a group of natives, equipped with the simplest tools, are following this method to produce a satisfactory all-weather road.



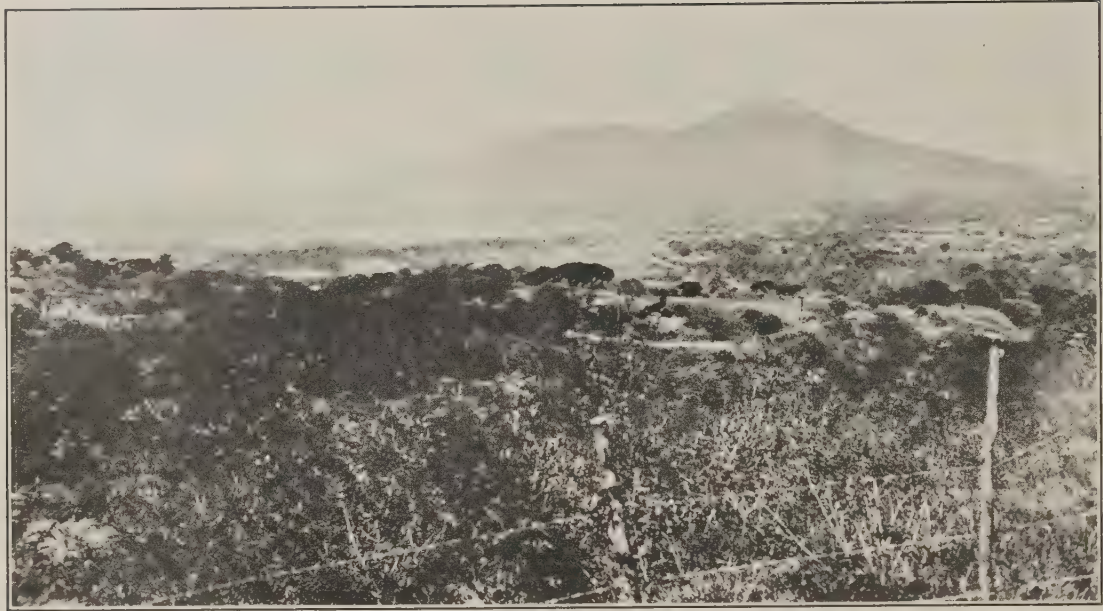
TEGUCIGALPA, CAPITAL OF HONDURAS.

In the foreground, a new bridge which constitutes the main entrance to the city from the south; in the background, the president's palace. Tegucigalpa is the only Central American capital not touched directly by the proposed route of the inter-American highway. There now exists, however, an all-weather road between Tegucigalpa and San Lorenzo which crosses the proposed inter-American highway near the latter town. Honduras is the only Central American country that now has a paved road from the Pacific Ocean to the Atlantic Ocean.



THE HIGHWAY FROM SAN LORENZO TO TEGUCIGALPA, LOCALLY KNOWN AS THE HIGHWAY OF THE SOUTH, OFFERS UNPARALLELED VISTAS OF MOUNTAIN SCENERY.

The route traverses tropical lowlands for a short distance, and then rises into the mountain range in which Tegucigalpa lies at an altitude of 3,500 feet (a total distance of about 80 miles).



GENERAL VIEW OF THE CITY OF SAN SALVADOR.

In the distance, the Volcano of San Salvador, 6,400 feet high. On the slopes of the volcano are large coffee estates.



THE NATIONAL PALACE IN SAN SALVADOR, IN WHICH THE GOVERNMENT ADMINISTRATION IS CENTERED.



STREETS OF EL SALVADOR ARE PAVED IN AS MODERN FASHION AS MOST CITIES OF THE UNITED STATES.
Here some American equipment is in operation.



EL SALVADOR HAS A LARGER PERCENTAGE OF ITS ROAD MILEAGE IMPROVED THAN ANY OTHER OF THE CENTRAL AMERICAN REPUBLICS.

A scene on an important road leading from San Salvador to La Libertad, the principal port on the Pacific Ocean.



IN THE DAYS OF THE SPANISH CONQUEST, GUATEMALA WAS THE CAPITAL PROVINCE OF THE REGION NOW OCCUPIED BY ALL OF THE CENTRAL AMERICAN REPUBLICS EXCEPT PANAMA.

The country to this day bears many signs of the Spanish occupation. Here is a bridge over the Esclavos River, built in 1582 by slave labor to carry a highway which was to stretch south from the Guatemala capital and bind the other sections of the region to its rule. The bridge is in use today, and the proposed inter-American highway will traverse it.



GUATEMALA CITY IS THE LARGEST MUNICIPALITY IN THE CENTRAL AMERICAN REPUBLICS, WITH A POPULATION OF ABOUT 120,000. It lies at an elevation of 4,800 feet on the Atlantic side of the Continental Divide. It is picturesquely located on a rich plateau, in full view of many summits of the main cordillera. Towering above it are the three volcanic peaks of Acatenango, Agua, and Fuego, side by side, each approximately 14,000 feet high.



A SECTION OF THE ROAD FROM GUATEMALA CITY TO THE MEXICAN BOUNDARY, WEST OF CHIMALTENANGO.



LAKE ATITLAN, THROUGH THE PANAJACHEL VALLEY.

Says John L. Stephens (Incidents of Travel in Central America, Harper and Bros., 1871): "From the moment this lake opened upon us until we left it, our ride along it presented a greater combination of beauties than any locality I ever saw." Lakes Atitlan and Amatitlan were recently stocked with land-locked salmon.



PAVED HIGHWAY IN THE MOUNTAINOUS REGION NEAR PUEBLA, SOUTH OF MEXICO CITY.
The grandeur of the natural scenery and the skill of the highway engineer are happily combined in this photograph.



TYPICAL SECTION OF THE INTER-AMERICAN HIGHWAY AS IT NOW EXISTS ABOUT 60 MILES NORTH OF MEXICO CITY.
The entire route between Mexico City and the United States boundary will shortly be of similar or better character.



RIVER CROSSING OF THE INTER-AMERICAN HIGHWAY OVER THE TULA RIVER NEAR VALLES, NORTH OF MEXICO CITY.

The view shows rugged mountain scenery typical of this region.

PROPOSED INTER-AMERICAN HIGHWAY

REPORT OF A RECONNAISSANCE SURVEY FOR THE
PROPOSED INTER-AMERICAN HIGHWAY

PART II.—REPUBLIC OF PANAMA

BUREAU OF PUBLIC ROADS
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

PANAMA

GENERAL SECTION

HISTORY

The first European to set foot on the Isthmus of Panama was Rodrigo de Bastidas, a wealthy notary of Triana, Spain, who in 1501 explored the north coast of the Isthmus as far west as Punta Manzanillo. Columbus touched at and named Puerto Bello in 1502. The first Governor was Diego de Nicuesa, appointed in 1509 by Ferdinand. Nicuesa started a small settlement which he called Nombre de Dios. After a rule of but a few months he was deposed and soon thereafter governance fell into the hands of one who, possessed of many of the elements of statesmanship, had stowed away in a wine cask when Ojeda set sail from Santo Domingo to become Governor of Nueva Andalucia (now a part of Colombia). Four years later this stow-away, from the mountain height of Pirre, viewed the Pacific Ocean (Sept. 29, 1513), waded into the Gulf of San Miguel, and took possession of all the lands and islands bordering upon the sea, "from pole to pole", for his sovereign of Castile and Leon, "till the day of judgment". This was Vasco Núñez de Balboa.

In 1514 Pedro Arias de Dávila arrived as newly appointed Governor of Castilla de Oro (Golden Castile) as Panama was then called. This man, known to history as "Pedrarias", was perhaps the most murderous monster ever to appear in the blood-smeared pages of conquistadorean history. The historian Oviedo declares that Pedrarias, in the 17 years of his career in Panama and Central America, "sent 2,000,000 Indians on the journey of death." Among his political victims was Balboa, whom he beheaded in 1517. Pedrarias founded (the old) Panama City in 1519. For a century and a half this city was the southern terminus of the renowned "gold road" over which were transported the gold and silver ingots from Mexico and Peru across the Isthmus to Las Cruces, thence by water to Puerto Bello, where they were loaded on waiting galleons and shipped to Spain. This traffic gave rise to the "racketeers" of those days, the freebooters and pirates headed by such notorieties as Drake, Morgan, Van Horn, and Lolonnois.

In 1671 Henry Morgan sacked Old Panama, which was burned in the struggle, and in 1674 the present city of Panama was founded upon a spacious shelf of rock which at low tide extends out to sea a distance beyond the cannon shot of those days.

Vestiges of the "gold road" and Old Panama still remain, and on the Island of Taboga may be seen the

cove in which Pizarro outfitted his vessels for the conquest of Peru.

Panama continued under Spanish rule until 1821, when it revolted and formed a union with Colombia. The town of Los Santos (on the proposed inter-American highway) was the first place on the Isthmus to declare for independence.

Previous to 1903 several abortive attempts were made to effect a permanent separation from Colombia and in that year, stimulated by the desire to have the Canal pass through its territory, the then Department of Panama separated from Colombia, declared its independence, and was recognized as a republic with Dr. Amador Guerrero as the first president.

In 1904 the Hay—Bunau-Varilla treaty between the United States and Panama was ratified, by which the former secured sovereign rights in the Canal Zone, a trans-Isthmian strip of land extending for 5 miles on each side of the projected Canal. Construction of the Canal was undertaken by the United States in 1904, after having been initiated by the French engineer, De Lesseps, in 1881 and abandoned in 1899 because of financial difficulties. The first vessel went through the Canal in 1914.

Indian, Spanish, English, French, Dutch, Portuguese, and African, all have played their roles in the bloody and intriguing struggles in this theater of events the record of which presents a kaleidoscopic display of human passions without parallel in any other quarter of the globe. Cacique and conquistador, priest and picaroon, statesman and scapegrace have won and lost, and their remains have mingled with the jungle growth. Says Dr. C. L. G. Anderson, in his scholarly volume, *Old Panama* (1911):

The Bay of Panama has been the scene of exploits unsurpassed in the legends of Greece, and needing only a Homer to make them appear heroic.

GEOGRAPHY, TOPOGRAPHY, AND AREA

The Republic of Panama is located on the Isthmus of Panama which joins the continents of North and South America. It extends from approximately 7°10' to 9°45' north latitude, and from 77°15' to 83° west longitude. It is interesting to note that at Panama City the sun appears to rise from the Pacific Ocean and to set in the Atlantic Ocean. This is due to the peculiar shape of the isthmus, which is bent twice upon itself like the Greek letter sigma. Colon is northwest of Panama.

Panama is bounded on the north by the Caribbean Sea, on the east by the Republic of Colombia, and on the south by the Pacific Ocean, and on the west by the Republic of Costa Rica. Excluding the Canal Zone its area is 32,388 square miles.

The Continental Divide extends east and west throughout the Republic. It reaches its maximum height near the Panama-Costa Rica boundary where the summit of the Volcano of Chiriqui attains an elevation of approximately 11,000 feet. Probably the lowest elevation in the range occurred at the point where the Culebra Cut was made during the construction of the Panama Canal.

The country is well watered by numerous streams that find their sources in the higher mountains and there are large areas of valuable tablelands, foothills, and valleys which finally blend together into the coastal plains that are found along the Atlantic and Pacific Oceans.

There are sections that are highly adaptable to agriculture, stock raising, mining, and lumbering. On account of the variations in altitude, the varying topographical features, and the accompanying changes in climatic conditions, there may be found areas that are highly productive of a great many of the products grown in the temperate climates as well as those indigenous to the Tropics.

CLIMATE AND RAINFALL

Panama has an equable climate. The mean annual temperature on the Atlantic side of the Isthmus in the Canal Zone is 79.8° F. and the mean variation is from 75.8° to 85.1° F., while on the Pacific coast at Balboa Heights in the Canal Zone the mean annual temperature is 78.6° F. and the mean variation for the years of record is from 72.9° to 87.4° F. In the higher altitudes of the interior of Panama the mean temperature is about 66° F.

There is a short period during the middle of the day when the heat becomes somewhat oppressive, but this condition is usually alleviated in the wet season by refreshing rains and in the dry season by the trade winds. The nights are almost invariably pleasant and the early morning hours are delightful and refreshing.

There is much rain during the wet season which extends from May to December inclusive, but practically none during the dry season. The rains are intermittent, usually beginning in early afternoon and continuing for several hours; there are at times exceedingly heavy rains which continue for several days. The average total annual rainfall on the Atlantic side of the Canal Zone at Cristobal is 128.42 inches and on the Pacific coast at Balboa 68.51 inches, over periods of 59 and 31 years, respectively.

It will be seen that the average total annual rainfall on the Atlantic side is more than double that on the Pacific, which indicates that a highway on the Atlantic

slope of the Continental Divide would be more costly to maintain than one on the Pacific side. The maximum rainfall in Cristobal on the Atlantic side for 24 hours over a period of 59 years shows 11 inches as against 7.57 inches over a period of 31 years at Balboa on the Pacific side. Undoubtedly, however, there are as heavy rains over short periods of time on the Pacific as on the Atlantic side of the Isthmus, and it is very probable that with equal run-off areas the provisions for drainage should be the same for either side.

Until within the past few years there has been no attempt to secure rainfall data in the interior of the Republic and many of the recently established stations have complete records for a single year only. Therefore, accurate forecasts of the amount of rainfall to be expected during any given month or year are not possible.

POPULATION

According to the official estimate the population of Panama in 1930 was 467,000. On the basis of racial classification, made by the Panama Association of Commerce in 1922, the population is made up of the following elements, stated in percentages: White (American and European descent), 12; Indians, 7; Mestizos, 60; Negroes, 20; Orientals (Chinese, Japanese, and East Indians), seven-tenths of 1 percent. The density of population is 16.4 per square mile. Approximately 70 percent is rural and 30 percent urban. The population of the principal cities in 1930, in round numbers, is shown in table 1.

It will be noted that Panama and Colon account for more than 22 percent of the total population.

TABLE 1.—*Population of principal cities in 1930*

	Population
Panama (capital).....	74, 000
Colon.....	30, 000
David.....	5, 600
Chitre.....	4, 100
Penonome.....	3, 200
Aguadulce.....	2, 500
Santiago.....	2, 200
Total.....	121, 600

ECONOMIC SECTION

National wealth.—According to the Government tax list prepared in 1922, the latest available, the value of all taxable real property in Panama was \$112,600,000, 25 percent of which was represented by building lots and houses in the cities of Panama, Colon, David, and Bocas del Toro. Since that year real estate in Bocas del Toro has somewhat depreciated as soil exhaustion has curtailed the banana production of that area, and the importance of the town has decreased. On the other hand, about 5 years ago the American company controlling Bocas fruit production opened up an extensive banana area on the Pacific coast extending from Puerto Armuelles to Progreso, with a large seed bed in

Tonosi, and the real-estate development in those territories more than offset Bocas depreciation. Since 1922 there has been considerable real-estate development in the mountain section of the Province of Chiriqui and in various other localities of the country, while apartment and dwelling construction in Panama City, particularly in the suburb of Bella Vista, along the Bay of Panama, toward Juan Diaz, and other subdivisions, has proceeded apace.

There has been a tendency on the part of retired American officials and employees of the Canal Zone to acquire permanent residence in the Republic. The life is pleasant, the climate is agreeable, and the Panamanians are charming and hospitable. Few places in the world offer to people of retiring age such attractive environment. Today real estate in Panama City carries a very high valuation (Colon less so) as evidenced by the high rents exacted. As will be noted in the table on national wealth, urban land and improvements account for 70 percent of the total, a large part of which is to be credited to the capital city.

All things considered, it seems fair to assume that Panama real estate has appreciated in value fully 25 percent above that set forth in 1922. The sum of \$155,000,000 is not believed to be an extravagant figure in estimating the value of Panama real estate. This would include all private property, government property, and ecclesiastical property. For lack of authentic data that value is accepted.

Lack of data concerning other items of the national wealth of Panama compels a resort to somewhat arbitrary figures, based on more or less refined guesses arrived at from traveling the country, fragmentary statements of officials, and estimates of business men.

In his Memoria de Hacienda of 1922, the late Dr. Eusebio A. Morales, for many years Panama's Minister of Finance, mentions 300,000 hectares (about 750,000 acres) of land devoted to pasture. How much of this is sown and how much natural is not known; but, giving it an arbitrary value of \$20 a hectare, the total would be \$6,000,000.

Estimates of the number of head of cattle range from 100,000 to 350,000. Dr. Morales estimated 300,000. Cattle production has not advanced since 1922, but has probably declined. Great expectations of the sale of beef cattle to the Canal Zone did not materialize, principally for the reason that bids of Panama stock raisers were too high. Probably 200,000 is a fair estimate as to the present number of cattle in the country which, under proper management, could support 1,000,000 cattle. As one travels south from Nicaragua, cattle increase in value. The Panama valuation should average about \$20 a head, or \$4,000,000 for the lot. Other livestock and fowls may be grossed at \$1,500,000.

Other than for prospectus purposes, it is doubtful if any adequate survey and estimate of the mineral

resources of Panama has ever been made. The Panama Corporation (formerly British, now in Canadian hands) has concessions for the mineral exploitation of immense tracts of land on either side of the Canal Zone and it is stated that the company has invested four or five million dollars in development work. A purely arbitrary figure of \$10,000,000 is adopted to cover mineral resources and development.

The value of nationally owned railroads, wharves, the Banco Nacional, and other Government utilities, is estimated at \$4,000,000.

Cultivated lands and improvements would include the United Fruit Co. investments, reported by the American commercial attaché in 1930 to be \$15,000,000 and probably \$5,000,000 would cover all others. In 1915 the Panama National Printing Office published a pamphlet prepared by Isidoro Hazera, stating that the total of public lands at that time was 5,773,600 hectares, or roughly two-thirds the superficial area of the Republic, excluding the Canal Zone territory. The valuation given per hectare at that time was from \$1.50 to \$6. It is estimated that at least 4,000,000 hectares of these public lands remain in the possession of the government which, accepted at their lowest valuation, would add \$6,000,000 to the national wealth. Probably another 750,000 hectares are privately owned and uncultivated, worth, say, \$2 a hectare, or \$1,500,000.

Concerning forests and lumber equipment there is a superabundance of conflicting statements and reports. The foreign promoter has been indefatigable. Unquestionably, in a number of localities now more or less inaccessible and away from the more important water courses there are still to be found valuable stands of timber. There are excellent prospects around Bahia Honda, and the Darien region will some day yield a wealth of hardwoods. Arbitrarily, \$6,000,000 is set as the value of this item.

Additionally, Panama has an annual income in perpetuity (or so long as the Canal is operated by the United States) of \$250,000, equivalent to 4 percent on \$6,250,000. About \$6,000,000 remains of the so-called "constitutional fund" of \$10,000,000 paid to Panama by the United States when the Canal rights were acquired; this fund is invested in New York realty and normally yields annually something more than \$300,000. These two sources of income are pledged for loans.

Table 2 results from an attempt to approximate Panama's gross wealth.

Foreign investments other than public debt are estimated at \$33,000,000, and the net wealth of the Panama people is therefore about \$193,250,000. The net wealth of Panama, per capita, may be estimated at \$482, and the wealth of the Panama people, per capita, at \$412.

TABLE 2.—*Gross wealth*

	Value
Urban lands and improvements.....	\$155, 000, 000
Cultivated lands and improvements.....	20, 000, 000
Uncultivated lands, public and private.....	7, 500, 000
Pasture, sown and natural.....	6, 000, 000
Mineral deposits and developments.....	10, 000, 000
Forests and equipment.....	6, 000, 000
Livestock of all kinds.....	4, 500, 000
Railroads, banks, wharves.....	4, 000, 000
Constitutional fund.....	6, 000, 000
Capitalized income of \$250,000.....	6, 250, 000
Total.....	225, 250, 000

Employment and wages.—Normally the percentage of those gainfully employed in Panama is somewhat larger than that characteristic of the Central American countries, due in part to Canal Zone industry, and in part to exploitative activities, chiefly of foreigners, in agricultural and mining enterprises. The Canal Zone wage scale, relatively high for that part of the world, has exercised a beneficial effect on wages throughout the Republic, in gradual diminuendo westward from the Canal Zone to the Costa Rican boundary. Just prior to the depression many hundred of laborers were employed on the national highway (part of the proposed inter-American highway) at wages (or piece-work equivalent) ranging from \$1 a day for unskilled labor to \$3.50 a day for skilled workers. These road wages, largely a reflection of the Canal Zone wage scale, in turn affect the wages of agricultural and cattle workers, who normally are paid from 60 cents to \$1.20 a day.

Treating Panama City and Colon together, the population of the two cities totaling approximately 105,000, it is estimated that in normal times 25 percent, or 26,250 is gainfully employed. Tourist and Canal Zone purchasers, banking and transportation, and general business activities, swell the per capita income to not less than \$500 per annum, or a total for these cities of \$13,125,000. Of the remaining 362,000 of Panama's population, at least 20 percent is gainfully employed in normal times, their annual earnings being the equivalent of about \$250, or a total of \$18,100,000. This would make the annual total for gainful occupations in the Republic \$31,225,000, or nearly \$65 per capita. In his *Memoria de Hacienda* previously mentioned, Dr. Morales estimated the per capita income of the rural dweller as somewhat less than \$60 a year, but there was a marked increase in wage rates and number employed in the decade following 1922, largely attributable to highway construction. Said Dr. Morales in 1922:

A little corn, rice, and salt, a few plantains, a suit of unbleached cotton, a palm hat, and a machete are the chief necessities of our laborers.

But with the advent of good roads there has come a decided increase in the number of articles which enter into the native diet, and an advance in sartorial array.

In 1922 it was uncommon to see an interior native wearing shoes. In 1932 it was rather uncommon to see one without shoes; and along the national highway is a large number of small general stores, operated chiefly by Chinese, which display quantities of American canned goods and other comestibles. The highway has been an excellent trade missionary.

PRODUCTS AND INDUSTRIES

Agriculture.—On the part of the Panamanian people there appears to be very little organized effort in agriculture. Practically all initiative in this field has been undertaken by foreigners, and reliable statistics as to agricultural production are almost wholly lacking.¹

Bananas.—Foremost in the agricultural development of the country is banana cultivation, the exportation of bananas accounting for nearly 75 percent of Panama's total exports. The industry is controlled by the United Fruit Co. which began its operations in the Almirante region about 20 years ago. For some years this section was one of the greatest banana producers on this hemisphere, but soil exhaustion and the so-called "Banana wilt" have practically ended banana culture there, much of the Almirante land now being devoted to cacao production. The United Fruit Co. within the past 5 years has moved to the Pacific coast, where it has a very large banana development reaching from Puerto Armuelles to Progreso, with a considerable area in Tonosi devoted to seed beds. Bananas grow all over the coastal and lowland regions of the Republic. The fruit company makes contracts with small growers in and around the Canal Zone and in the Darien for their output. It is general opinion that a banana farm in Panama is profitable for from 15 to 20 years before the ravages of the banana wilt make its abandonment advisable. Efforts have been made to control the spread of the disease or, by cross-breeding, to produce a plant that is immune, but so far without success.

Coconuts.—Sporadic attempts have been made to organize the coconut-raising industry. Some years ago the Boston-Panama Coconut Co. secured title to an immense tract of land in the Mariato region, not far from Montijo Bay, with the idea of devoting it to coconut production, and later some areas in the San Blas region were secured by American citizens for the same purpose. The Boston-Panama Co. planted a considerable acreage to Jamaican coconut trees, but had great trouble with a species of beetle. About this time Philippine and East Indian coconuts and copra assumed price control of the world market, and the Panama interests were unable to compete. This did not apply to the unorganized regions from which the San Blas Indians garner their uncultivated nuts, and

¹ Credit for much of this information on agriculture is due to Dr. H. D. Lupi, whose brochure *La Agricultura de Panama* (1915) contains interesting data.

a comparatively large number of these nuts is shipped to Colon and sold to buyers who send them to the United States. Coconuts grow uncultivated in many parts of the Republic. The productive capacity of the country is enormous. When a practical method of extracting oil from the coroz, cohune, and coquito nuts is perfected, Panama will be able to dispose of a heavy tonnage of these palm nuts which at present grow all over the country, particularly along the national highway.

Sugarcane.—There are two sugar centrals of some importance in Panama, both located in Aguadulce, one belonging to former President Chiari. These two plants have been supplying about 65 percent of the refined sugar allocations under Government control of output, or approximately 6,500 tons. Cane is grown in many parts of the country, but a great deal of it is used in the production of rum and alcohol. Cane-fields will be found all along the national highway and at Montijo, Calobre, and Ocu. Land agents have made extravagant statements as to the potentialities on the north coast for sugarcane production. Cane in that section displays astonishing growth, but the saccharine content is said to be low on account of heavy and prolonged rains. One of the Aguadulce companies has a plan for irrigating that region to increase production, but the present uncertainty as to the outlook for sugar has shelved this project. It has been estimated that Panama could, without great effort, produce 50,000 tons of sugar annually, or five times her present output.

Cacao.—Except for the development of the United Fruit Co. in the Almirante region, little has been done to increase this resource. It is interesting to note that what is said to be the finest quality of cacao known is grown in Chorch, not far from David, in the Province of Chiriqui. The plantation is owned by Senor Ildefonso Preciado. Chorch cacao commands a fancy price in the London market, but the supply is very limited. Cacao grows wild in the Darien, in the Province of Cocle, in Tonosi, Sona, Puerto Bello, and a number of other localities.

Coffee.—Arabian-type coffee is grown in limited quantities in Chitre, Santa Fe, Los Santos, and Cocle for local consumption. For over 40 years it has been grown commercially in Boquete, which produces an exceptionally fine grade. A Norwegian grower in Boquete, who exercises great care in processing his coffee, at one time had a standing offer for his output of 2 cents a pound above the highest market quotation for fine coffees in Hamburg. In recent years there has been remarkable development on both sides of the Chiriqui Volcano in the extension of coffee acreage, and there is friendly rivalry between the Boquete region (the elder) and El Volcan region. The latter will ultimately be tapped by the national highway, and potential production in that area has been estimated

as high as 150,000 quintals. Two or three years ago groups of Canal Zone employees were purchasing coffee lands in El Volcan with a view to bringing them into bearing at about the time the owners would reach the age of retirement. From Santa Barbara, Calif., a small colony of Americans has taken up scientific production. A number of Europeans are likewise engaged. El Volcan region has been advancing rapidly in this respect, although recent low coffee prices have greatly retarded development. Liberian coffee is grown in small quantities in many lowland sections, purely for local use. At present the bulk of the coffee raised in Panama is domestically consumed, but export will increase with the improvement of the foreign coffee market.

Tobacco.—No scientific methods of raising tobacco have as yet been introduced. It is cultivated in a primitive way in some parts of Chiriqui, Veraguas, and Los Santos. The tobacco of Bubi, Guineal, Tonosi, and Paraiso is said to be of superior quality, lacking only proper cultivation and curing to make it equal to the best. Dr. Lupi states that the flat lands of many of the rivers would produce excellent tobacco, particularly those of Rios Bayano and Santa Maria.

Corn.—As one travels south from the central portion of Costa Rica the importance of corn in the native diet (made into tortillas) dwindles. In Panama the tortilla is somewhat uncommon. No special attention is given to corn, although it grows well, and under modern methods of cultivation Panama could produce it in abundance. It is generally used for animal food.

Rice.—This staple is grown in small patches all over the Republic, but only recently has there been any organized effort to raise rice in commercial quantities. An American company started such an enterprise in Darien about 2 years ago, but the success of the venture is yet to be determined. Nearly every native husbandman has his rice patch. The species "oriza montana" (upland rice) predominates. Panama should not be dependent on imported rice.

The foregoing may be considered the major prevailing agricultural products of Panama. There are a great many others that suggest possibilities, among them being various fiber-bearing plants such as the bromelias, henequen, and toquilla for making hats, and gengibrillo for hats and hammocks; the legumes; the castor oil plant; various root foods, such as yuca and oto; the plantain; and many others. In Boquete, Chiriqui, a California navel orange graft on a native stock has produced oranges of Brobdignagian size and fine flavor. There are a number of localities, particularly in the vicinity of Montijo Bay, where pineapples would grow well.

Oranges show excellent results when the trees are properly tended. One product peculiar to Panama for which there is an occasional market is musk-seed. A botanist making investigations for a Chicago institute

reports large natural areas in Darien of a plant from which rotenone is extracted, a substance deadly to cold-blooded life but harmless to warm-blooded animals.

In the mountain temperate region surrounding the Chiriqui Volcano, table vegetables of all kinds show astonishing growth. The foreign residents in that vicinity appreciate what can be done with truck farming, and once the Panama national highway enables trucks to travel from the El Volcan region to the Canal, it is quite likely that a remunerative business will be done with the Canal Zone and with transiting ships. By far the greatest agricultural possibilities of the Republic of Panama and the most agreeable climate are in the Province of Chiriqui. Twenty or more years ago C. F. Schultz, horticulturist in the employ of the Isthmian Canal Commission, after a survey of the country, wrote:

Beyond the Rio Chiriqui, there exists a beautiful extension of territory which, though not yet under cultivation, will become, in time, very productive * * *. The trip from Potrerillos to Boquete is through a most beautiful region incomparable for its fertility.

To quote from a pamphlet published by the Panama Association of Commerce in 1924:

The Province of Chiriqui could produce all kinds of provisions in sufficient quantities to meet the demands of the local population, but, nevertheless, larger importations are made of commodities needed to meet the requirements of the people which could be easily produced locally. This situation does not signify that the people are averse to work, but is due rather to the fact that up to a short time ago, they had no means of transport for their products.

The Chiriqui Railroad opened up the Boquete side of the Chiriqui Volcano. The national highway has stimulated agricultural development on the Concepcion side. The extension of that highway to the Costa Rican border will be followed by the development of the region mentioned by Schultz.

Other tropical fruits which thrive in Panama are the papaya, nispero, zapote, guava, avocado, mango, guanabana, and maranon, the last-named known in the United States as the cashew, the nut growing on the tip end of the fruit. In recent years pear, peach, apple, and quince trees have been set out in the Chiriqui highlands. They are thriving, but are still too young to bear. None of these fruits is grown on a commercial scale.

It is estimated that there are 200,000 head of cattle in the Republic. There is no stock census. Cattle are slaughtered for domestic consumption. Cattle have degenerated greatly, but some attempt has been made to breed stock immune to ticks by the introduction of Zebu strains. Scientific breeding and attention would enable Panama to export cattle products. As it is only a few green hides are exported.

Panama is said to be an old Indian word signifying "plenty fish", yet this is an industry that has received

very little encouragement from the Government. It is the paradise of the deep-sea sport fisherman. A few small sailing craft manned by natives, Jamaicans, and Japanese keep the local markets of Colon, Panama, and the Canal Zone, supplied. In recent years motor boats equipped with refrigeration come from California occasionally for tuna which have been driven into Panama waters. Both coasts of Panama swarm with many varieties of fine food fish.

Timber resources.—In 1910 the Smithsonian Institution conducted a botanical survey of the Isthmus, sending Mr. Henry Pittier for that purpose. He was loaned to Panama in 1914 by the United States Department of Agriculture to establish an agricultural experiment station. Pittier collected and assembled 120 species of rare Panama woods, many of the commoner species not being included.

Numerous ventures have been made in timber exploitation in Panama, some of them fairly successful, most of them failures. The failures have been due to numerous causes, chiefly to unscrupulous promoters who were more concerned with selling stock than cutting stumpage. Other failures have been caused by lack of sufficient capital to exploit concessions. Practically all timber near those watercourses down which it could be floated to loading point has been cut away and it is an expensive procedure to work logs out of the back areas. In lumber and mining activities Panama has suffered vicariously because of indigent entrepreneurs and unprincipled concessionaires. On the other hand, it has probably been too free in granting concessions without investigating the probity and responsibility of the grantees.

According to the Panama Association of Commerce, at a point on the Rio Bongo in Darien, 90 miles (145 kilometers) from Panama City, there is a large stand of timber, principally mahogany and Spanish cedar. To quote:

The entire region between the Bayano River, about 45 miles from the capital city and the Tuira River, which taps the heart of the Darien country, is covered with hardwood forests and affords excellent side lines in the form of ivory nuts, balata, ipecacuanha, copaiba, balsa, rubber, etc.

The mountain sections of northeastern Panama Province abound in hardwood forests. The western reaches of the Province of Colon, stretching from the coast to the Andean mountain ranges, are reported to be rich in timber, but at present inaccessible. A large variety of valuable hardwoods is reported in the Indian territory of San Blas, principally mahogany. Building timber and dyewoods are said to be abundant in Veraguas Province. In the territory between Potrerillos and Boquete, province of Chiriqui, C. F. Schultz reports "an extraordinary number of flowering trees, great cedars, mahogany, and other hardwoods which reach a height of over 100 feet."

In the Bahia Honda region there are some extensive stands of mahogany and maria, a wood used in the United States for veneers. Several attempts by an apparently serious but poorly capitalized company have been made to exploit this region and some shipments of maria were made to the United States just before the depression set in.

The most important commercial woods are mahogany, Spanish cedar, maria, guayacan (called, but not true, *lignum vitae*), espave, balsam, and cocobolo. Attempts to cultivate balsa, which grows in the lowlands, have been unsuccessful.

Forest products other than those mentioned as growing between the Rios Bayano and Tutuira, and more or less common all over Panama, are vanilla, sarsaparilla, rubber of the *Castilloa* species, and a tree gum (identity not known) in Darien now being imported to the United States and used as an adulterant of chicle in the manufacture of chewing gum.

The shores of Panama are fringed deeply with mangrove extract from the bark of which is excellent for tanning leather.

MINING

Gold.—The mining of this metal harks back to conquistadorean days. In 1684 the Espiritu Santo mine of the Cana group was known as "the richest gold mine yet found in America," which may indicate that promoters were active even at that early date. It has been estimated that a British company operating in the Cana group in the nineties extracted between \$20,000,000 and \$30,000,000 worth of the precious metal. Later French interests joined with the British and it is said that disagreements between the two resulted in abandonment of the workings. Many thousands of dollars worth of machinery, now obsolete, is at the site, the village of Santa Cruz de Cana. In 1925-26 the Panama Corporation, a British concern, promoted by D. Elliot Alves, secured concessions to exploit an extensive area in the Republic of Panama, on both sides of the Canal, chiefly in the provinces of Darien and Veraguas. The Cana group was later acquired by this company. Under the concession this area was to be policed by appointees of the Panama Government, their salaries to be paid by the company. The Panama Co. is said to have expended in the neighborhood of \$5,000,000 in developmental work, including the construction of roads, principally in connection with the Remance and Hatillo mines near Santiago. Statements of eldoradean optimism were published, but up to date no appreciable results in actual gold production have been reported and the holdings of the Panama Corporation recently passed into Canadian hands.

One or two American companies have secured concessions for placer mining on some of the rivers of Darien, one of these being in the Pinogana district along the Rio Tuquesa, the alluvials running 72 to 98

cents a cubic yard. The Rio Tuquesa and its tributaries were for centuries primitively worked by the Indians. Gold has been found near Bocas del Toro and Golfo Dulce. Another prospect is at Cucullo near the Caribbean coast of Veraguas. There are also small idle mines near the Rios Cocle and Belen; still others are reported at Las Tablas, Las Minas, El Mineral de Veraguas, Sona, Lovaina, Gualaca, and San Lorenzo. It seems probable that there are many gold locations in Panama but, due to the broken nature of the country, the feasibility of profitably working them is problematical. Samples of gold ore taken from near Chepo, identical in structure with some taken from the Bahia Honda region, have been seen. Quartz veins occur in La Serrania de Darien.

Copper.—This is said to exist at San Felix and near the trail from David to Bocas del Toro. It also exists on the Azuero Peninsula.

Iron.—This has been found in the Sierra Cristobal and in other parts of the country, but no workings are reported.

Manganese.—This ore is found south of Puerto Bello and up the Rio Chagres to the Rio Boqueron. An analysis made by one of the leading American steel companies showed samples with manganese dioxide, 84.20 percent; iron, 2.12 percent; copper, 0.15 percent; silica, 0.78 percent; manganese content, 57.99 percent. The so-called "Popham" concession recently passed into Panamanian hands.

Coal of an inferior grade has been found in the vicinity of Bocas del Toro. A number of attempts have been made by two large American companies to locate petroleum, but while seepages are reported here and there, actual results have been so unpromising that all borings have ceased.

Other mineral products are salt procured from the salt flats of Aguadulce, and mineral waters found near Santiago and Calobre. There are large reefs of white coral at Puerto Bello which would be suitable for the manufacture of cement.

Pearls.—Since early Spanish days pearls and pearl shell have been found in the waters surrounding the Pearl Islands, a group beginning 45 miles (72 kilometers) from Panama City, and in Bahia Honda. The cleaned shell is exported.

Manufacturing.—Except in one or two industries, manufacturing in Panama has made little advance. There are two fair-sized breweries, one in Panama City, the other in Colon, making beer of a quality which must be pleasing to the American and native palates as the breweries are in daily operation. A bourbon whisky distillery in Panama City is making progress. Rum is made in several parts of the country. Sugar is, perhaps, the largest strictly Panamanian factory output. Production has been limited, however, by agreement to about 10,000 tons annually, all consumed in the country. The two leading sugar mills have brought

in expert sugar makers from Louisiana as advisers and Panama granulated sugar is of good quality. Probably seven-tenths of the production is in Aguadulce.

There is a factory which is devoted to the manufacture of straw hats, importing the straw braid and findings for that purpose instead of encouraging the nimble-fingered natives of the interior to prepare the braids from home-grown straws. There are a number of small capacity industries putting out furniture of improperly seasoned rare woods; small concerns making soap, candles, perfumes of unique odors, cigars, cigarettes, some tropical clothing, and paper boxes; ice plants; soft-drink plants; and shoe factories. A number of Japanese are engaged in making shirts. Panama and Colon are principally devoted to tourist trade, the East Indian and Chinese merchants dealing in Oriental goods, wares, and merchandise. The largest merchandising business is done in French perfumes, the small Panama tariff duty permitting them to be sold at relatively low prices.

No statistics are available concerning the total annual output of Panama factories, their number, or capitalization.

TRANSPORTATION AND COMMUNICATION

Ocean transport.—To describe Panama's ocean connections with the world at large would necessitate the enumeration of all the transportation lines of the various nations that make use of the Canal.

Domestically, Panama has on the Atlantic side coastwise connections from Colon by small craft to Puerto Bello, the San Blas region, and occasionally as far as Colombia. There are a number of good harbors along this route which will admit vessels of considerable draft. Westwardly, there are sailings to Bocas del Toro of small craft and United Fruit Co. boats. Save for the last named, these services are more or less unscheduled and casual. For 5 months of the year, the period of trade winds, it is dangerous to navigate the coast in small boats. The dangers at river mouths have greatly discouraged the development of the Caribbean coast area, access to which will eventually be secured by lateral roads running from the national highway.

There are two or three more or less regular sailings of small motor craft from Panama City westward to the Provinces of Chiriqui, Cocle, Herrera, Los Santos, Panama, and Veraguas, and eastward to Darien. Also a number of small schooners ply between the capital and the provinces. On none of these boats are passenger accommodations attractive, nor is any effort taken to make them so.

Cargo clearances from Panama City for Pacific coastwise ports totaled nearly 16,000 metric tons in 1926 and 8,948 tons, or a decrease of 44 percent, in 1932. Cargo entries to Panama City from coastwise ports totaled 32,300 tons in 1926 and 21,120 tons, or a decrease of 34 percent in 1932.

Cargo clearances from Colon for Atlantic coastwise ports declined from 4,469 tons in 1926 to 1,901 tons in 1932. Entries to Colon from coastwise ports increased from 1,697 to 1,771 tons. The year 1926 was selected for purposes of comparison as that was about the time the national highway began to record rapid progress toward and beyond Santiago.

Numerous factors have to do with the decline of total coastwise tonnage moved in the Pacific coast trade. For example, foreign-import tonnage decreased from 93,655 metric tons in 1926 to 68,196 tons in 1932. Construction in the provinces was almost at a standstill in 1932 and there was less buying in all lines. Nevertheless, giving due consideration to these factors, the figures still present evidence that the national highway, which best serves the Provinces of Los Santos, Panama, and Veraguas, is getting an increasing share of the freight exchange between those provinces and the capital city and as the highway penetrates, and is perfected, into the Province of Chiriqui a similar situation will doubtless become manifest.

Tables 3 and 4, compiled from the Statistical Bulletin of the Panama Government show the distribution and origin of the coastwise trade, both on the Atlantic and the Pacific.

TABLE 3.—Clearances from and entries to Panama City in the coastwise trade

Province	1926		1932	
	Tons	Value	Tons	Value
Chiriqui:				
Clearances.....	3,903	\$1,084,000	3,310	\$780,000
Entries.....	6,430	904,000	2,362	402,000
Cocle:				
Clearances.....	4,873	1,346,000	2,034	268,000
Entries.....	6,497	911,000	3,395	544,000
Darien:				
Clearances.....	936	206,000	274	46,000
Entries.....	3,662	127,000	3,301	83,000
Herrera:				
Clearances.....	2,522	646,000	2,648	267,000
Entries.....	2,795	561,000	3,109	165,000
Los Santos:				
Clearances.....	1,111	312,000	592	116,000
Entries.....	1,845	329,000	1,723	173,000
Panama:				
Clearances.....	2,358	406,000	45	5,000
Entries.....	10,510	235,000	6,892	103,000
Veraguas:				
Clearances.....	285	96,000	45	5,000
Entries.....	561	89,000	338	38,000
Total:				
Clearances.....	15,988	4,096,000	8,948	1,487,000
Entries.....	32,300	3,156,000	21,120	1,508,000
Total exchange.....	48,288	7,252,000	30,068	3,095,000

TABLE 4.—Clearances from and entries to Colon in the coastwise trade

Province	1926		1932	
	Tons	Value	Tons	Value
Bocas del Toro:				
Clearances.....	3,342	\$1,367,000	1,838	\$258,000
Entries.....	273	112,000	924	126,000
Colon:				
Clearances.....	1,127	251,000	63	19,000
Entries.....	1,424	62,000	847	17,000
Total:				
Clearances.....	4,469	1,618,000	1,901	277,000
Entries.....	1,697	174,000	1,771	143,000
Total exchange.....	6,166	1,792,000	3,672	420,000

Inland waterways.—The Rio Bayano or Chepo flows west and south to the Gulf of Panama for about 150

miles (240 km) and it is claimed that 130 miles (209 km) can be navigated by rafts and small craft. Boats of 10-foot (3-m) draft are said to be able to go up the river 8 miles (13 km) to Anna Luz, while those drawing 5 feet (1.5 m) can reach El Capitan 13 miles (21 km) up the river.

Although there are many streams flowing into the Caribbean along the northern coast of Panama, few are navigable for any distance and all have sandbars at their mouths. The two most important are the Chagres and the Tarire. The Panama Canal has used the valley of the former. The Tarire is navigable for light-draft steamers for about 15 miles (24 km) and flows through a rolling valley lowland about 100 or 150 square miles in area. The lowlands here are at times flooded and at times dry. Mangrove swamps extend along a considerable part of this northern shore.

The principal rivers of the southern coast are the Tuira and its tributaries, the Chucunaque and Tavisá, and the Rio Chepo or Bayano, the Rio Grande, and the Rio Chico. The Tuira is 5 miles (9 km) wide at its mouth and 10 to 15 fathoms in depth. Via the Tuira and the Chucunaque, vessels drawing 10 to 12 feet (3 to 3.6 m) can go as far as the Indian town of Yaviza.

Highways.—In 1932 Panama had about 900 miles (1,440 km) of motor roads, 350 miles of which were all-season roads and the remainder passable during the dry season; compared with 500 miles (800 km) in the preceding year. There are also about 200 miles (320 km) of all-season road in the cities of Panama and Colon, and in the Canal Zone.

The central highway and its feeder roads make up the national highway system, with the exception of a few miles in the vicinity of Colon on the Atlantic side. The central highway runs near the Pacific coast and serves the most thickly populated provinces of the country, and their respective ports. It is included in the proposed inter-American highway throughout the Republic.

Roads in Panama are constructed by the Central Road Board (established in 1920) which is charged with all work on national highways. This board is a highly efficient organization. The municipalities have their respective public works departments concerned with road work in their districts. (Road building and maintenance in the Canal Zone—United States territory—are controlled by the Engineer of Maintenance, Balboa Heights, Canal Zone.)

The National Government spent or allotted approximately \$15,790,000 on the highways of Panama between 1920 and 1930, according to the report of the chief engineer of the Central Road Board, and the greater part of this sum went to construction. From July 1, 1931, to June 30, 1932, \$559,418 was expended, and up to June 30, 1933, the sum of \$16,620,000 had been expended, distributed as follows:

Highways.....	\$12, 000, 000
Bridges.....	1, 300, 000
Maintenance.....	2, 000, 000
Property and equipment.....	1, 000, 000
Miscellaneous.....	320, 067
Total.....	16, 620, 067

The trunk road to David has progressed slowly, but satisfactorily, considering the small sums which the Government has been able to make available for this work. This year traffic was established from Panama City to Puerto Vidal, and from Remedios to David. The section from Vidal to Remedios, about 28 miles (45 kilometers), will be a costly piece of construction.

The principal income at the disposal of the Central Road Board, according to a recent statement made public by Engineer Tomás Guardia, chief of the board, is derived from the tax on gasoline, which yields about \$30,000 a month; 25 percent of the vehicle tax, yielding about \$1,000 a month; and a direct (poll) tax levied in amounts of \$3, \$5, and \$12, depending on the earnings of the taxpayer. This may be paid in cash or worked out on the road at the rate of \$1 a day. Total road income in 1933 was \$430,000.

The present program contemplates maintaining the roads in use, and it is hoped that an all-year surface may be applied to the central highway on the 80-mile (130-kilometer) section between Sona and David which, to date, has been graded and drained only. The highway is now open to all-year traffic from Panama City to Sona, 215 miles (346 kilometers). This entire route is a part of the proposed inter-American highway, and opening of the highway from Santiago, in Veraguas Province, to David, in Chiriqui Province, is the paramount objective of the Central Road Board.

At one time it was the practice to let contracts for construction of various sections of the road, but now all of this work is performed by the board, employing its own equipment and labor.

In 1928 Panama secured a special construction loan of \$5,000,000 from the United States, which was wisely expended for the purpose secured.

In 1931 efforts were made to obtain an additional loan of \$5,000,000 for highway construction purposes, the Government's chief engineer going to New York for the purpose, but without success. This failure resulted in the slowing-down of work on the Santiago-David section, on which, as stated, \$4,000,000 already has been spent, thus causing considerable loss to the Government; but it is hoped that the work may be resumed in the near future.

Imports of road-building machinery and materials from the United States, which amounted to \$432,000 in 1929 and \$465,000 in 1930, were in order of their importance: Cement, excavators, power shovels, spare parts, and air compressors. This trade has held up fairly well and the total value of such imports in 1932

was \$318,000. In that year there were also imported corrugated culverts to the value of \$6,000.

All the road-making machinery in use is modern and kept in excellent condition by the Government machine shop in Aguadulce. It is estimated that the Panama Government owns \$1,000,000 worth of road-building equipment, including 11 stone-crushing plants, 4 power shovels, and 100 motor trucks.

Railways.—Other than the Panama Railroad, an American Government holding, connecting Colon on the Atlantic side with Panama City on the Pacific side, about 50 miles (80 kilometers) which is used to some extent by the Republic, Panama has a national railroad from David to Boquete, with a spur line to Potrerillos. This system also connects David with Pedregal, and with Alanje, Progreso, Concepcion, and Puerto Armuelles. There is also some mileage radiating from Almirante, operated by the United Fruit Co. in hauling out bananas. Colon is connected with Fort Randolph by a 10-mile (16-kilometer) railroad.

Airways.—Most of the 20 or more airports in the Republic of Panama are grass-covered fields suitable for the landing of aircraft, but not marked in any way nor equipped with any facilities. Two of the most important airports are located at Panama City and David.

One of the Pan American Airways' services between Cristobal, Canal Zone, and Miami, Florida, passes through Central America, stopping at David and Panama City; the other reaches Panama via Colombia. A mail and passenger service from Panama City to the interior towns of the republic is maintained. Pan American Grace Airways operates a regular service from Panama City down the west coast of South America and across to Buenos Aires and Montevideo. Another service connects Colombian points with Panama. A regular trans-Isthmian service, Panama-Colon, is maintained by an American company.

Automotive statistics.—On January 1, 1933, there were registered in Panama and the Canal Zone 7,001 passenger automobiles, 509 busses, and 510 trucks, making a total of 8,020 motor vehicles. Figures on distribution of these vehicles within the country are not available, but it is assumed to be more general than in other Central American countries, because of the wider distribution of serviceable highways.

HIGHWAY ECONOMICS

Existing bus service.—Bus operations between Panama City and the towns and villages of the interior reached by the national highway are without schedule. The busses are individually owned and there are no bus companies. About 40 busses (locally called "chivas") are engaged in this traffic in the dry, and half that many in the wet season. The average bus capacity is 20. Table 5 gives scheduled operations between Panama City and immediate environs, and to and from the Canal Zone.

TABLE 5.—Scheduled bus operations between Panama City and environs, and to and from the Canal Zone

Operator	Termini	Trips	Number of busses	Passenger capacity
United States Army	Corozal - Panama City	Every 45 minutes	6	25
Do	Amador - Panama City	Every 30 minutes	4	27
Do	Fort Clayton-Panama City	do	4	20
American Bus Line	Balboa - Panama City	Every 15 minutes	2	20
Union Panamena de Autobus	Bella Vista Panama City	Every 5 minutes	23	20
Blue Bus Line	do	do	10	20
Hindi Supply Co.	do	do	85	20
Ancon - Balboa Bus Line	Ancon-Balboa	Every 30 minutes	1	20
Harry Comley	do	5 daily	1	20

Future highway development.—The following are suggested as practicable locations for future road construction, connecting with the proposed inter-American highway, and over which bus and truck operations could eventually be developed:

1. Panama City to Colon, via Juan Diaz and Madden Dam to France Field. This would take in sections of the old "Gold Road" used by the early Spaniards in transporting bullion from Peru and Mexico to the Atlantic coast. A survey of this section was recently completed by Canal Zone authorities. A large amount of construction might be obviated here by linking the Madden Dam-France Field section with Canal Zone highways. Bus and automotive traffic over a trans-Isthmian highway from Colon to Panama would be relatively large.

2. The transformation to a highway of the present pack-horse trail from David, Province of Chiriqui, to Bocas del Toro would do much to advance the economic well-being of the western end of Panama.

3. A highway from Colon to Puerto Bello, which is situated on a small deep-sea harbor and which in Spanish days was an important distributing point.

Tourist and other private traffic.—No estimate has been made as to the probable traffic on the Panama link of the inter-American highway, but indications exist of a considerable increase as the roads in the western section of the Republic continue to be extended and improved.

The best indication of what may be expected in the Republic of Panama is furnished by some very recent figures released to the Panama American (daily) by the executive secretary of the Canal Zone. Prior to the completion of the so-called "Thatcher Highway", from the north side of the Canal to Arraijan, motor vehicles were obliged to go through the Canal Zone to the Pedro Miguel Locks and await a small ferry which operated but a few hours a day. They then went via Empire and Paja, striking the main line at La Chorrera. It was a tortuous journey. The Thatcher cut-off saved 7 miles (11 kilometers) and was built by the Canal Zone. A free service ferry connects Balboa with the highway approach. It is operated by the

Canal Zone and day service began September 1, 1932. Table 6 is a tabulation of vehicles carried by the ferry across the Canal during the 2 years ending August 31, 1932, and August 31, 1933, by months.

TABLE 6.—*Vehicles carried across the Panama Canal by ferry for the period indicated*

Month	1931-32 ¹	1932-33 ²
September.....	5,958	17,390
October.....	5,440	11,749
November.....	5,221	10,294
December.....	5,536	11,421
January.....	6,632	13,515
February.....	7,446	13,662
March.....	10,174	15,585
April.....	7,855	18,669
May.....	6,149	12,643
June.....	4,655	11,171
July.....	5,611	11,920
August.....	5,574	11,817
Total.....	72,251	159,836

¹ All transits at Pedro Miguel.

² All transits at Balboa.

The annual reports of the Canal Zone show the numbers of single or one-way trips, and vehicles and passengers transported, for fiscal years ending June 30, 1932, and 1933, as follows:

	Trips	Vehicles	Passengers
Fiscal year 1932.....	16,144	75,941	398,037
Fiscal year 1933.....	17,996	147,105	837,174

It is estimated that about 50 percent of those persons transported across the canal is on pleasure bent and 50 percent on business; while of the vehicles, 75 percent is on business and 25 percent traveling for pleasure. It is believed that an all-night crossing would increase the traffic fully 25 percent.

PUBLIC LANDS

The Panama Association of Commerce is authority for the statement made in 1924 that the greater part of the lands in Darien Province (formerly a part of the Province of Panama) belong to the nation and are available after due process of law for agriculture and other enterprises. That was before the Panama Corporation acquired its subsoil rights. Practically all the land in the San Blas region of the Province of Colon is national property, but the Indians are to be considered. The greater part of the forest lands of the Province of Bocas del Toro is national property. National lands are also to be found in practically all the remaining Provinces. In 1924, according to the Association of Commerce, "Of the entire territory of the Republic of Panama (slightly more than 87,000 square kilometers, excluding the Canal Zone area) 27,800 square kilometers are inhabited; 1,050 are under cultivation; 870 are privately owned woodlands, and the remainder (57,500 square kilometers) are national lands" to be distributed in accordance with Panama law. There have been some registrations

since 1924. Land titles can be registered under an adaptation of the Torrens system, but the purchaser should have competent legal assistance. Panama lands are classed as 66,700 square kilometers mountainous, 10,500 lowlands, and 7,500 islands. To some Czechoslovak colonists the government about a decade ago sold land along the present national highway at \$3 a hectare. This colonization project failed, due principally to poor location.

FOREIGN TRADE

During the 5-year period 1926-30, inclusive, the Republic of Panama imported an annual average of \$16,850,000 worth of goods. The average for exports was \$3,800,000. This would indicate on the face of it a trade balance against Panama for the 5-year period, of something like \$65,000,000. But such is not the case. A very considerable percentage of the goods entering Panama and reported as imports is never consumed in the country but is resold under contract or otherwise to Army and Navy units, tourists, and Canal Zone residents. In normal years over 200,000 tourists touch at Panama annually. During the depression years of 1931 and 1932 there was a decrease of over 50 percent in the number of tourists touching at Panama, which no doubt had much to do with the large decrease in Panama imports during those years. Fleet maneuvers of the American Navy are held every other year in Panama waters. It has been estimated that the American naval personnel leaves from \$2,000,000 to \$3,000,000 during these visits in the purchase of perfumes, silks, linens, and oriental merchandise. Tourist expenditures are even greater.

Another lucrative business which brings money into Panama is the sale of lottery tickets which, though not permitted in the Canal Zone, finds an avid, optimistic, and numerous clientele among American and foreign residents and sojourners in the Republic and the Canal Zone. When the American Fleet is in, tickets are speedily sold out. Apparently at no time has Panama experienced any great embarrassment due to adverse trade balances, and the high rents which merchants continue to pay for their stores and shops indicate that in normal times business is remunerative.

United States trade records show American exports to Panama ranging in value from \$41,000,000 in 1929 to \$15,000,000 in 1932. These statistics include shipments to the Canal Zone, and "Canal Zone for orders"; the latter being transshipped to various South and Central American countries, and in some instances to the Orient. To credit zone and "orders" shipments to the Republic is very misleading to American exporters.

In 1929 the United States furnished 68 percent of Panama's total imports and 61 percent in 1931. There is an appreciable shift to British and Japanese mer-

chandise. Our ranking exports to Panama are iron and steel, cotton fabrics, machinery, wheat flour, vegetables, and meats.

Other than bananas the principal Panama exports are coconuts, cacao, cattle hides, and gums. The United States takes approximately 95 percent of Panama's exports.

FINANCE

Government receipts and expenditures.—The Republic of Panama operates on a biennial budget. That for 1932-33, the latest reported is given in table 7.

Table 8 is a comparative tabulation of the debt of the Republic of Panama on October 1, 1932, and September 1, 1933.

It should be noted that in addition to the above the National Government is contingently liable for external loans of the Banco Nacional de Panama which it has unconditionally guaranteed. The outstanding amount of these loans June 30, 1933, was \$3,097,500 and they are in default. On May 15, 1933, Panama announced that the interest could not be met on its loan of 1928 and subsequently announced a plan for payment of one-third the interest. In a bulletin issued in December the Panama Government stated:

An internal floating indebtedness of considerable proportions in relation to reduced income had been incurred and eventually had to be dealt with by the new administration which came into office on October 1, 1932. The measures taken for dealing with the floating debt include the funding of a large part into 10-year 6-percent internal bonds and liquidation of the balance out of current revenues over a period of several years.

TABLE 7.—*Budget for 1932-33*¹

[Unit of currency is the balboa, equal at par of exchange to \$1 United States currency]

Receipts		Expenditures	
Source	Amount	Purpose of expenditure	Amo
Imports	\$5,702,432	Government and Justice	\$3,093,820
Exports	90,000	Foreign relations	386,440
Consular and re-export fees	24,000	Treasury	1,451,275
Internal taxes	4,019,900	Public instruction	2,622,008
National services	504,000	Agriculture and public works	1,000,002
Patrimonial revenues	1,508,613	External debt	2,071,250
		Internal debt	1,200,000
		Contingencies	24,150
Total	11,848,945		11,848,945

¹ Does not include receipts which have been allocated to special funds, such as the gasoline tax and the lottery tax.

TABLE 8.—*Comparative table of the debt of the Republic of Panama on Oct. 1, 1932, and Sept. 1, 1933*

EXTERNAL DEBT

Item	Interest rate	Oct. 1, 1932	Sept. 1, 1933
Loan of 1923	5½	\$4,064,500.00	\$3,979,000.00
Loan of 1928	5	11,454,500.00	11,356,000.00
Back interest on the loan of 1928 amounted to		15,519,000.00	15,335,000.00
Less the amount deposited with the Guarantee Trust Co.			209,508.27
Total		15,519,000.00	15,544,508.27

TABLE 8.—*Comparative table of the debt of the Republic of Panama on Oct. 1, 1932, and Sept. 1, 1933—Continued*

INTERNAL DEBT

Item	Interest rate	Oct. 1, 1932	Sept. 1, 1933
Panama Brewing & Refrigerating Co.	6	\$130,625.00	\$137,200.00
United Fruit Co.	6	72,500.00	66,500.00
National City Bank, Panama	6	640,465.39	615,465.39
Treasury bonds of 1930	7	69,727.31	
Promissory notes of treasury, 1932	7	402,792.89	
Promissory notes for urbanization	6	165,270.80	
Agua Dulce Dock	7	40,000.00	
Promissory notes in favor of Carl Friese & Co.	6	11,267.95	
Promissory notes in favor of Panama Electric Co.	6	10,250.00	
Promissory notes for market extension	7	55,000.00	44,000.00
Loan from national bank	7	75,000.00	
Accounts pending		560,000.00	
Back salaries		550,000.00	
Certificates of credit		109,962.34	35,000.00
Bonds of 1932		26,758.00	750.00
Conversion bonds	6		1,111,120.00
Total		2,919,619.68	2,010,035.39

SPECIAL CONTRACTS

Aqueduct and streets, Panama	2	\$771,411.06	\$748,499.38
Aqueduct and streets, Colon	2	645,282.22	626,116.69
Total		1,416,693.28	1,374,616.07

RECAPITULATION

External debt		\$15,519,000.00	\$15,544,508.27
Internal debt		2,919,619.68	2,010,035.39
Special contracts		1,416,693.28	1,374,616.07
Total		19,855,312.96	18,929,159.73

American investments.—Estimated American investments in Panama at the end of 1930 totaled \$46,551,000 according to Trade Information Bulletin No. 767 of the Bureau of Foreign and Domestic Commerce, United States Department of Commerce. Of this amount, \$28,709,000 was in the form of direct investments; the balance, \$17,842,000, was invested in portfolio investments as follows: National Government securities, \$14,785,000; municipal securities, \$480,000; and Government-guaranteed corporate securities, \$2,577,000.

A list compiled by the office of the American commercial attaché of American firms and individuals having direct investments in Panama, as of July 1, 1929, gives \$32,831,000 as the estimated value of the American holdings. The difference between this figure and the figure of \$28,709,000 contained in the previously mentioned bulletin is due probably to the fact that in the latter estimate American sources of information were used, while the former estimate was made on the basis of Panamanian sources of information.

British investments in Panama at the end of 1928, according to an estimate which appeared in the London Economist, issue of October 25, 1930, totaled \$4,000,000. Data regarding investments in Panama by other foreign nations are not available, but are relatively unimportant.

PANAMA CANAL ZONE

Four hundred and twenty-two years after the first voyage of Columbus to the New World, the Panama Canal was opened for traffic in August 1914. Four hundred years almost to a day after Vasco Nunez de Balboa discovered the Pacific Ocean, the first test operation of the Gatun Locks took place, September 26, 1913. Balboa's discovery was followed by 16 years of search for a strait connecting the Atlantic and Pacific Oceans, in the course of which the Strait of Magellan was discovered, 1520.

In 1529 Alvaro de Saavedra, a companion of Balboa in the discovery of the Pacific Ocean, following discussions of the leaders of that day as to the advisability of making a strait, prepared the first plans for the Panama Canal. Such a project made an irresistible appeal to the maritime nations of the seventeenth century. Many surveys were made and projects developed during ensuing centuries.

The first actual work on the Canal was begun in January 1882 by a French company under the celebrated French engineer, de Lesseps, who had built the Suez Canal. Dissensions and lack of funds led to final abandonment of the project by the French company, and in 1904 the United States acquired the rights and property of the company. American occupation of the Canal Zone began in May 1904.

The line of the Panama Canal goes up the valley of the Rio Chagres on the Atlantic slope, passes through the ridges of the Continental Divide in the Gaillard Cut, and descends to the Pacific Ocean down the valley of the Rio Grande. Following this route the Canal is 40.27 statute miles in length from shore line to shore line, and 50.72 miles from deep water to deep water. The Atlantic entrance to the Canal is about 33½ miles north and 27 miles west of the Pacific entrance.

Organization.—The Panama Canal is an independent establishment directly under the President of the United States, who is represented by the Secretary of War in the administration of Canal affairs. Governmental authority is vested in the Governor of the Panama Canal, who is selected from the Corps of Engineers, United States Army. The Governor is also president and one of the stockholders, by transfer from his predecessor, of the Panama Railroad, a quasi private entity engaged in shipping, hotel operation, and numerous other activities. A number of departments and divisions are included in the Canal Zone organization. Under the Department of Operation and Maintenance come the various divisions charged with Canal operation, ship repairs, fortifications, and municipal engineering, the last-named handling highway construction and repair. The Supply Department includes the commissary and quartermaster division, motor transportation division, and others. The Health Department looks after sanitation, both in the

zone and in territory of the Republic of Panama contiguous thereto, including Panama City and Colon. There are also the usual executive and accounting departments.

The operation of the Canal and railroad, and adjuncts thereof, requires a force of approximately 3,100 Americans locally known as "gold" employees, and 9,000 "silver" or alien employees, the majority being Jamaica Negroes. Many of the alien employees reside in the Republic of Panama. Including Army and Navy personnel there are approximately 40,000 residents of the Canal Zone.

The Panama Canal Zone proves an exception to the aphorism of Thomas Jefferson, in that it is the most governed, and perhaps the best governed political entity under the jurisdiction of the American flag. Engineering and landscape architecture have transformed what was once a swamp into one of the most beautiful tropical settings in the Western Hemisphere, and the example of sanitation, renovation, and good management has been a practical benefit to many of the governments in the Isthmian region. Great efficiency is displayed in the mechanics of operation of the Canal and its related activities; health conditions are equal, if not superior to those of any metropolis in the United States. Its hospitals are celebrated throughout the length and breadth of Latin America. Education progresses from the primary grades to a junior college, and a technical college which might be attended by Latin American students has been suggested.

With the exception of imports ranging from six to eight million dollars annually, the Canal Zone is practically self-contained. The commissaries are veritable department stores, confining sales to employees of the United States Government, except in specific cases. The zone roasts its coffee, and makes its chocolate, vanilla, sausage, and other food products. It possesses facilities for the repair of everything from a locomotive to a watch.

Dishonesty and crime are at a minimum. Indigence is unknown. The housing of employees is in general better than that of the officials. Almost every American and English sport is indulged in by both sexes, and from the Zone have come crack swimmers, marksmen, and baseball players.

According to General Information, a pamphlet issued by the Panama Canal:

Tolls are levied on the net tonnage of the ships, which is the interior space which can be devoted to the carriage of cargo or passengers. The rate for laden ships is \$1.20 per net ton, Panama Canal measurement, and the rate for ships in ballast, 72 cents per net ton; with the proviso that the amount collectible shall not exceed the equivalent of \$1.25 per net ton as determined under the rules for registry in the United States, or be less than 75 cents per net ton on the same basis. Each "net ton" is 100 cubic foot, or 2.83 cubic meters.

For the first 7 years after 1914 Canal operations were hampered by slides, and the World War and its

aftermath retarded normal development. Hence the end of the fiscal year 1921 was fixed upon as the date that the Canal should be considered as completed, and the cost up to that time has been calculated at \$525,812,661. Since 1921 there has been expended \$7,293,348 for capital improvements.

The annual average for the 10-year period of operations, 1923-32, gives the following according to Panama Canal figures:

Number of transits.....	53, 631
Net tonnage.....	25, 930, 683
Tolls.....	\$23, 686, 139
Tons of cargo.....	25, 952, 183
Net revenues.....	\$15, 624, 823

The above figures do not include toll-free craft such as United States Government vessels, vessels owned by Panama and Colombia, and vessels going into drydock or lying up for repairs.

Excellent paved roads are constructed at both ends of the Canal, but there is no trans-Isthmian highway. A paved road extends from Cristobal south as far as Gatun, and another extends north from Ancon through Balboa as far as Gamboa. Another road goes to Madden Dam. The construction of a highway from Alhajuela, near Madden Dam, to a point near France Field on the Atlantic side is being discussed. This road would be largely in Panama territory. Should it be built, vehicles could go from Panama City through the zone and out to Madden Dam, thence to Colon on a paved highway. This would give trans-Isthmian travel through a very interesting section of country.

A ferry has recently been installed at Balboa Basin, crossing the Canal, and connecting opposite La Boca with the Thatcher Highway which extends across the Zone to Arraijan where connection is made with the central highway of the Republic. The traffic over this route is elsewhere referred to.

Table 9 lists the bus routes now operated in the Canal Zone.

TABLE 9.—Bus lines in operation in the Canal Zone

Operator	Termini	Trips	Season	Number of busses	Passenger capacity
The Panama Canal.	Madden Dam-Ancon.	3 daily..	All year...	1	22
The Panama Canal (school busses).	Ancon-Balboa.....	4 daily..	September-June	3	30
Do.....	Quarantine Station-Balboa.	...do....	...do....	1	20
Do.....	Pedro Miguel-Balboa.	...do....	...do....	2	30
United States Army.	Corozal-Panama City.	Every 45 minutes.	All year...	6	25
Do.....	Amador-Panama City.	Every 30 minutes.	...do....	4	27
Do.....	Fort Clayton-Panama City.	...do....	...do....	4	20
American Bus Line.	Balboa-Panama City.	Every 15 minutes.	...do....	2	20
Ancon-Balboa Bus Line.	Ancon-Balboa.....	Every 30 minutes.	...do....	1	20
Harry Comley.....	...do....	5 daily..	...do....	1	20

On the Cristobal side busses operate from Colon to Fort Davis and the Gatun Locks, and from Colon to

France Aviation Field, the Fleet air base and submarine base at Coco Solo, and Fort Randolph. These busses are in the hands of the United States Army and post exchanges. They haul civilian employees of the Government, Army and Navy personnel, and school children. James Powell operates 24 busses, day and night, all season, from Mount Hope to Colon and various military and naval establishments. A few busses owned by West Indians haul "silver" employees employed at the forts and naval bases.

Article II of the Convention of 1903, ratified by the Governments of the United States and Panama, provides that—

ARTICLE II

The Republic of Panama grants to the United States in perpetuity the use, occupation, and control of a zone of land and land under water for the construction, maintenance, operation, sanitation, and protection of said Canal of the width of 10 miles extending to the distance of 5 miles on each side of the center line of the route of the canal to be constructed; the said zone beginning in the Caribbean Sea 3 marine miles from mean low water mark and extending to and across the Isthmus of Panama into the Pacific Ocean to a distance of 3 marine miles from mean low water mark with the proviso that the cities of Panama and Colon and the harbors adjacent to said cities, which are included within the boundaries of the zone above described, shall not be included within this grant. The Republic of Panama further grants to the United States in perpetuity the use, occupation, and control of any lands and waters outside of the zone above described which may be necessary and convenient for the construction, maintenance, operation, sanitation, and protection of the said canal or of any auxiliary canals or other works necessary and convenient for the construction, maintenance, operation, sanitation, and protection of the said enterprise.

The Republic of Panama further grants in like manner to the United States in perpetuity all islands within the limits of the zone above described and in addition thereto the group of small islands in the Bay of Panama, named Perico, Naos, Culebra, and Flamenco.

ARTICLE III

The Republic of Panama grants to the United States all the rights, power, and authority within the zone mentioned and described in article II of this agreement and within the limits of all auxiliary lands and waters mentioned and described in said article II which the United States would possess and exercise if it were the sovereign of the territory within which said lands and waters are located to the entire exclusion of the exercise by the Republic of Panama of any such sovereign rights, power, or authority.

Although the Canal Zone is a minute possession considered in relation to the geography of the world, and although the United States exercises the rights of sovereignty in perpetuity by virtue of a treaty with a foreign country, nevertheless, this possession is undoubtedly the most spectacular and one of the most valuable of our outlying territories. Its economic significance to this country and to the world is vast, both absolutely and in its ramifications. Its relation to the national defense is paramount. As an example of what can be made of the American tropics, it is

almost miraculous. Associated with its construction and absolutely essential to it, advances were made in the knowledge of tropical medicine, unsurpassed before or since. It stands before the world today as a monument to engineering science, medical knowledge, and managerial and administrative efficiency. It is visited annually by thousands of tourists from all parts of the world and never fails to produce on those from the United States a feeling of intense loyalty and satisfaction in the accomplishment and farsightedness of their Government.

Today it lies as isolated from the United States as though it were an island and is almost wholly dependent for supplies, personnel, and all communication upon the service of ships.

Should the inter-American highway be constructed, this supremely valuable noncontiguous territory would be provided with land communication to the United States, and should some untoward event interrupt the delivery of supplies to the Canal Zone by water, delivery could be made by land and the products of Central America might augment other more remote sources upon which the Canal Zone now depends.

TECHNICAL SECTION

The proposed route.—The termini of the Panama section of the inter-American highway under consideration at present are the National Palace in Panama City and a point on the Panama-Costa Rica boundary. This boundary line follows the ridge that divides the waters of the Rio Chiriqui Viejo in Panama from those of the Rio Coto Brus in Costa Rica, and the point where the highway crosses it is approximately 6.25 miles (10 km.) northeast of Canas Gordas.

The proposed highway affords connection at Panama City with coastwise vessels, the Panama Railroad, and the Pan American Airways, as well as with the Panama Canal.

The highway makes junctions at the capital with a road leading southeast to the village of Chepo, a distance of about 38 miles (61 kilometers); at Balboa, with a road leading to Gamboa where ocean-going steamships anchor, and with the road system of the Canal Zone; near San Carlos, with a semi-improved road leading to El Valle, a resort section in the mountains; at Divisa, with an improved road leading to Puerto Chitre, Puerto Guarare, and Puerto Mensabe, all of which are more or less important ports for coastwise shipping on the Gulf of Panama; at Santiago and Sona, with several short sections of road leading to interior points. These roads are passable for automobiles only in dry weather. At David connection is again made with the Pan American Airways and the Chiriqui Railroad system; and at Concepcion with the Chiriqui Railroad. Junctions with several short sections of dry-weather road are made at David.

There were three routes considered in Panama, all of which utilize the constructed, partly constructed, and located sections of the central highway of Panama from Panama City to Concepcion. At this point they separate, one following the adopted route which is described in detail hereinafter, and the others pursuing alternate routes 1 and 2. The description of these latter and the reasons for their rejection are as follows:

Alternate route 1 follows the line reconnoitered by the members of the Intercontinental Railway Reconnaissance Survey. It crosses the Rio Chiriqui Viejo at a lower elevation than does the adopted route or alternate route 2. It reaches the Costa Rican boundary line at the crest of a ridge between the Rio Chiriqui Viejo and streams flowing westward to the Gulf of Dulce. From here it crosses many ridges and streams and finally, turning northward, reaches its highest elevation near Canas Gordas. It would connect with the recommended line at or near Platanilla. This is the shortest and most direct route between Concepcion and the Panama-Costa Rican boundary, and a highway with low gradients and minimum curvature could be located over the terrain. It would shorten the section of highway in Panama, but increase it in Costa Rica. Such a location would develop a territory adaptable to stock-raising, and there are parts of it where the cultivation of pineapples and bananas could be successfully accomplished, although the soil lacks fertility and is exceedingly rock-strewn.

An adverse decision was rendered to the adoption of this route for the following reasons:

1. It crosses the Pacific coastal drainage in the lower reaches of the streams, of which there are eight of considerable size.
2. It parallels for a part of the distance the line of a national railroad which serves a section of this territory.
3. It passes through a section that could be only partially adapted to the production of agricultural commodities. No mining, manufacturing, or lumbering industries are located in the region.
4. It has little scenic value.

Alternate route 2 follows the general route taken by the Intercontinental Railway Reconnaissance Survey to the vicinity of the Rio Chiriqui Viejo, continues north along this river to the mouth of the Rio Piedra Candela, and thence up this tributary of the Rio Chiriqui Viejo to the Costa Rican frontier.

This route is longer from Concepcion to the Costa Rican frontier than alternate route 1, but shorter than the recommended line. The approach to Costa Rica is facilitated over this route and it passes through the semihighland territory of Panama which is much more adaptable to general agricultural purposes than the lowlands. It lies between the highlands of the Chiriqui region and the low coastal section and would not develop the full agricultural potentialities of either region.

It does, however, open up the drainage basin of the Rio Piedra Candela which, though small, comprises some fertile lands.

The route was abandoned after considering the following facts:

1. It crosses the Pacific coastal drainage as in the case of alternate route 1 in the lower reaches of those streams between Concepcion and the Rio Chiriqui Viejo, thus necessitating expensive structures in each instance.

2. It lies for much of the distance in lowlands having limited agricultural potentialities compared with the adopted line.

3. It passes through a territory poorly suited for lumbering or mining industries.

4. It has limited scenic attractions.

The principal objection to alternates 1 and 2, however, is the fact that neither one includes that section of road from Concepcion to El Volcan which Panama has partly built for the purpose of serving a rich agricultural, salubrious, and scenic territory. It was desirable to incorporate this section of the road in the inter-American highway and approach Costa Rica over comparatively elevated terrain and through a section that has great possibilities for development.

Control points.—The following control points, all of which are on the present road system of Panama except the last two, are selected for the purpose of adequately defining the route:

1. Panama City.
2. Crossing of the Panama Canal at La Boca.
3. Penonome.
4. Aguadulce.
5. Santiago.
6. Sona.
7. Remedios.
8. David.
9. Concepcion.
10. El Hato (on the Llanos del Volcan).
11. Crossing of the Rio Chiriqui Viejo below the mouth of the Rio Santa Clara.
12. Low pass in the range of mountains dividing the waters of the Rio Chiriqui Viejo in Panama from those of the Rio Coto Brus in Costa Rica. This range is taken to be the boundary line between Panama and Costa Rica and is locally known as the Santa Clara Ridge.

Running description.—The route of the Panama section of the inter-American highway begins at the Palacio Nacional in the city of Panama and follows the city streets to the Canal Zone. It passes through the town of Balboa in the Canal Zone, crosses the Canal by a ferry, and continues in the Canal Zone over the Thatcher Highway to Arraijan, a small town in the Republic of Panama. It then traverses the Provinces of Panama, Cocle, Herrera, Veraguas, and Chiriqui.

The streets of Panama City and of the Canal Zone are paved as far as the Panama Canal. From the northwest shore of the Panama Canal to Arraijan a concrete road has recently been constructed, and from the latter point to Chorrera the highway has recently been surfaced with bituminous materials. From Chorrera to Sona, via San Carlos, Anton, Penonome, Aguadulce, Divisa, and Santiago, the road has a bituminous surface. From Sona to the Rio Vidal, at the time of making this report, grading and surfacing were practically complete; from the Rio Vidal to Remedios grading had been completed and the drainage structures were in place; and from Remedios to David the route had been graded and partly surfaced.

A preliminary survey had been completed from David to Concepcion, but no construction work had been done. Concepcion to Llanos del Volcan (El Hato) had been opened to traffic although the construction was incomplete. From El Hato to the Costa Rica boundary line no work had been done, but the reconnaissance survey had been completed. It should be noted that work is continuing on this highway as funds permit.

Table 10 shows concisely the status of the Panama section of the inter-American highway in the early part of 1933.

TABLE 10.—*Status of the Panama section of the inter-American highway, Mar. 1, 1933*

Locality	Distance		Total distance		Surfacing	
	Miles	Kilo-meters	Miles	Kilo-meters	Type	Width ¹
Canal Zone line	1.1	1.76	1.1	1.76	Concrete paving	Feet
Panama Canal	1.2	1.92	2.3	3.68	Bituminous and concrete.	(²)
Arraijan	6.2	10.02	8.5	13.70	Reinforced concrete.	18.0
Chorrera	12.8	20.40	21.3	34.10	Oiled macadam	18.0
Rio Las Lajas	31.5	50.50	52.8	84.60	do.	11.5
Rio Anton	34.0	54.50	86.8	139.10	Sand clay, oil treated.	11.5
Rio Chirube	29.4	47.00	116.2	186.10	Oiled macadam	11.5
Aguadulce	9.7	16.60	125.9	202.70	Oiled gravel	11.5
Rio Santa Maria	13.1	21.00	139.0	223.70	Gravel	11.5
Santiago	23.6	38.00	162.6	261.70	Macadam, gravel surface.	11.5
Cuartillo Creek	14.1	22.50	176.7	284.20	Macadam	11.5
Sona	15.0	24.30	191.7	308.50	Gravel	11.5
Rio Vidal	27.5	44.00	219.2	352.50	do.	
Remedios	29.8	48.30	249.0	400.80	Earth	
David	59.1	95.00	308.1	495.80	Gravel, partly surfaced.	11.5
Concepcion	15.2	24.50	323.3	520.30	Surveyed	
El Hato	19.0	30.50	342.3	550.80	Partly surfaced	
Costa Rica line	24.8	40.00	367.1	590.80	Reconnaissance complete.	

¹ Widths as given do not include shoulders, which are usually 1¼ meters wide.

² Varies.

The entire route in Panama lies to the south and southwest of the Continental Divide, and therefore crosses all of the drainage from these mountains to the Pacific Ocean. It is nearer to the coast than to the Divide with the exception of two short sections from Divisa to Santiago and from Concepcion via El Hato to the Panama-Costa Rican boundary. A location nearer to the mountains would tend to diminish

the size of the drainage structures, but would certainly increase their number and if the present alinement and grades were adhered to would materially increase the earthwork. A location, on the other hand, nearer to the seashore would decrease the number of drainage structures, but would materially increase their size, would diminish the value of the highway for the future development of the interior of the country, and the probabilities are that inferior foundation and unfavorable subsoil conditions would be encountered.

The location of the highway has been made with the idea of serving the principal centers of population. It passes through the most productive sections of the republic and in traversing the El Volcan area will open up a territory of extensive agricultural potentialities and one that is delightful for resort purposes as well as for hunting and fishing.

The topography of the Isthmus of Panama on the Pacific side consists of mountain ranges usually paralleling the coast, sloping plains, and sea flats. This general formation is interrupted by several ranges of mountains projecting from the interior elevations to within a short distance of the coast. The principal of these are the Campana Mountains between Arraijan and San Carlos, those between Santiago and Sona, and those between Sona and Remedios.

The route after leaving the Panama Canal passes over the foothills projecting from the Campana Mountains and then crosses the coastal plains bordering the Pacific Ocean which are slightly rolling in some stretches and practically level in others. These are traversed by many streams which have their sources in the main cordilleras and which are usually formed with steep, abrupt banks and with practically no perceptible valleys when viewed from a short distance. The whole vista appears to be a vast, level sabana. This coastal plain area extends almost to Penonome which is located in the foothills of the mountains.

After leaving Penonome level country is found almost to Divisa, from which point to Sona the terrain is again rolling and broken. From Sona to Remedios the entire line is in a semimountainous section with short level stretches of sabanas occurring at intervals, and from Remedios to David a rolling country interspersed with sabanas is found. After leaving David the terrain as far as Concepcion is slightly rolling and traversed by several streams with deep, steep banks.

From Concepcion to El Hato there is a continuous rise over the inclined plain to the foothills and then along the spurs of the Volcano of Chiriqui to the mountain area and elevated plateau. From the Llanos del Volcan to the Costa Rican boundary the proposed route lies in mountainous terrain for the entire distance.

The plain areas encountered along the route are much eroded, and broken to some extent by lofty hum-

mocks and hogbacks in irregular formation, generally decreasing in size toward the sea.

The country contiguous to the route offers splendid opportunities for obtaining a general knowledge of the Tropics as its topography continually changes as does the tropical growth and vegetation. In the mountainous sections is found jungle growth interspersed with many species of large trees, while on the plains there is a scanty growth of dwarfed trees and bushes.

The scenic attractions vary with the topography. Attractive and extensive views of distant mountains are seen throughout the route. These are particularly visible from the plains where there is little growth to offer obstruction to the view. It is somewhat different on the mountain slopes for the reason that long-distant views are interrupted by the dense tropical growth and the vista at these points is usually confined to narrow limits. There are points, particularly between Sona and Remedios, where magnificent views of the Pacific Ocean and of the bays, inlets, and islands that are so numerous along the coast can be obtained.

The graded section of the present central highway of Panama is in general 19.7 feet (6 meters) wide between the outer edges of the shoulders. This width has been increased in many places, especially where sharp curves occur and in sections in the sabanas where the construction of a wide section does not entail much additional initial cost.

Slopes have been examined which were originally vertical but have now assumed a curved section concave to the center line of the highway, and at the point of intersection of the original ground line and the slope there has grown in many places a mass of vegetation that acts as a roof and prevents further erosion of the slope by rain or wind. Where slopes are exposed to the prevailing winds and rain they continue to erode and in all probability will eventually assume the theoretical 1:1 slope. At points where sight distances are short the slopes are being cut back to increase the visibility.

To prevent the washing of the slopes on fills a very satisfactory method has been devised by the Panamanian engineers. The slopes are planted with a small shrub called "pinuela" which very much resembles the pineapple plant. In addition to preventing wash it serves when planted at the outer edge of the shoulder as a sort of precautionary guard rail and is very effective.

Ditches are ample for properly draining the roadbed and a standard minimum width of 19.7 inches (50 centimeters) is used for the bottom of the ditch. This width is increased where necessary. The slope from the outside edge of the shoulder to the bottom of the ditch is $1\frac{1}{2}:1$ ² and the minimum depth of the ditch is 9.9 inches (25 centimeters). In the standard section

² That is, there is a vertical drop of 1 foot for every $1\frac{1}{2}$ feet of horizontal distance.

the cut slopes are shown as 1:1 and the fill slopes as 1½:1.

The standard is rarely adhered to in the case of the cut slopes for in most instances they are left almost vertical. This is done in material that would slough rapidly under the alternate freezing and thawing in the temperate zones, but which seems to stand well in the Tropics. The policy of leaving vertical slopes during construction reduces the items of excavation, clearing, and grubbing and facilitates the measurement of quantities.

It is interesting to note that a large number of the posts for right-of-way fences are small branches of trees which, when planted, take root and eventually become healthy trees and at some places are so thick that it is unnecessary to place fencing between them in order to prevent the passage of stock.

The surfaced portion of the completed highway is of the featheredge type and in general is 11.5 feet (3.5 meters) in width, although wider at points where extra width is of particular advantage to traffic. The depth of the surfacing varies with the character of subgrade. On several sections the surfacing material was placed to a depth of 5.9 inches (15 centimeters) but it was found that failures occurred at many places. During the maintenance of these sections the policy of examining the subgrade where failures had occurred has been followed and the material replaced to a depth sufficient to hold up under traffic. This has proven very satisfactory and an excellent surface has resulted.

Shoulders are usually 4.1 feet (1¼ meters) in width, are compact, and are well protected from erosion by grasses and other vegetation. They are firm enough at all times to allow the easy and uninterrupted passage of vehicles.

From the foregoing it will be seen that it was not necessary or advisable to recommend or reconnoiter any route between Panama City and Concepcion other than the one that has been adopted by the Panamanian engineers as the central highway of Panama. A further reason for following this highway is that a large sum had been spent on its construction and it serves the principal centers of population as well as the most productive sections of northwestern Panama. The same is true from Concepcion to El Hato, a ranch house on the Llano del Volcan, where the selected route follows the partly completed road. The central highway of Panama from Panama City to El Hato is shown on plan and profile sheets 1 to 12, inclusive.

The reconnaissance of that section of terrain from El Hato to the Panama-Costa Rica boundary was undertaken without the aid of any topographic or reliable geographic maps of the region, but several available conjectural sketches produced from older explorations through these lands were examined. The

best graphical representation of the territory available for study consisted of a series of air photographs of the region. From these and field investigations involving instrumental work throughout practically the entire distance, the plan and profile sheet 13 was prepared. These aerial photographs of this section were specially obtained at the request of the Panamanian Government, the work being done by personnel of the United States Army Air Corps operating from their base at France Field in the Canal Zone. The photographic planes had to operate at an approximate elevation of 15,000 feet above sea level.

The reconnoitered and recommended route between El Hato and the Panama-Costa Rica boundary may be generally described as traversing the volcanic plain, "Llanos del Volcan", in a northwesterly direction, thence gradually turning to the west around the foot of heavily wooded mounds and spurs, and continuing on a northwesterly course to the crossing of the Rio Barriles near the Barrows Coffee Lands. It then follows generally in a westerly direction through jungle, occasionally crossing small cultivated clearings, and follows the slopes of Cerro Divisa near the coffee plantation operated by the Chiriqui Commercial Co.

Winding about the gentle side slopes of a large mountain the recommended route continues on a southwesterly course, remaining on the northern foothills of the ridge bounding the Rio Kaisan Basin to the south and west. It then turns to the northwest over an extensive, thickly obscured "planura" or tableland, upon whose surface numerous low mounds are superimposed in a disorderly manner. It takes advantage of a well-scarred ridge and the spurs left by erosion between the two streams, Quebrada Caballero and Quebrada Chiquero, and winds downward to the crossing of the Rio Chiriqui Viejo.

The ascent from the recommended stream crossing is made on the south and westerly slopes of the broad spur which forms the easterly flank of the steep valley of Quebrada Espanoles, or Chiquero. (In order not to confuse this with Quebrada Chiquero, east tributary of Rio Chiriqui Viejo, the name "Espanoles" was given to it since it borders the area called "Los Espanoles.")

After reaching the heights west of the Rio Chiriqui Viejo the route proceeds west by north over somewhat broken country to the long continuous ridge known as "Filo de los Huacales". This ridge is ascended on its southerly slopes and the descent is similarly effected on its northerly slopes. Following a generally westward direction through less broken country the route crosses Rio Rabo Gallo, Rio Chepo (also known to the native squatters as "Rio Brusca"), and Rio Guizado, all of which are tributaries of the Rio Chiriqui Viejo. The course from the Rio Guizado to the Rio Piedra Candela is over feasible terrain and in a generally

northwesterly direction; however, before reaching the latter stream it bears to the north, then to the northeast, and finally to the west.

In its final stretches the adopted route traverses easy ground, ascending gently and gradually to the foothills of an extensive mound whose crest lies on the division of waters between the Rio Chiriqui Viejo Basin and the Rio Grande de Terraba system in Costa Rica. The broad tablelike top of this mound is reached from the northern side on a spur of uniform inclination at a gradient not exceeding 7 percent.

Rio Chiriqui Viejo, the largest and swiftest stream in the province, lies in a canyon 300 to 500 feet deep and the bridge site selected is situated a short distance upstream from the mouth of Quebrada Caballero which enters the Rio Chiriqui Viejo from the left and approximately 1,640 feet (500 m) downstream from a point known in the locality as "Paso Chiquero." The latter is a site at which the river approximately doubles in width, allowing it to be forded during the dry season. The only foot trail in this locality leads out of the canyon in both directions away from the ford.

The west side of the recommended crossing is the southern extremity of a broad and substantial bluff which is approximately 50 feet above low water at the point where it juts into the streamway. It forms a vertical wall above the water line on its easterly side and consists of a visible outcrop of volcanic conglomerate of a sandy matrix interspersed with irregular masses of volcanic debris (rock and boulders).

The east side of the crossing is a low, planular strip of ground with signs of past inundations during exceptionally high water, probably caused by excessive rains alone or in combination with the effects of a restricted channel downstream. This terrain is bordered by a lower boulder-strewn flat contiguous to the stream, some 30 feet wide, which in the rainy season becomes part of the streambed.

Alinement.—The general alinement of that section of the Central Highway of Panama from Panama City to El Hato, which is included in the inter-American highway, is satisfactory. The proposed ultimate minimum radius of curvature is 164 feet (50 meters). There are at present, however, a number of places where curves of shorter radii occur, but these are gradually being improved by the maintenance forces in widening the traveled surface and cutting back slopes for better sight distances.

Two of the principal sections where short radii curves occur are in the Campana Mountains northwest of Chorrera, and between Sona and Remedios where the road crosses very irregularly shaped mountain ranges which in places descend abruptly and approach closely to the seashore. It is thought that excessive curvature here is justified for the present when due consideration is given to the fact that the

mountains are most irregular and their slopes very steep.

These sections will require a considerable amount of work and expenditure of funds in widening the roadway and flattening slopes before they can be brought to the standard of alinement. This can be done without exceeding to any great extent the maximum grade of 7 percent.

There are a few short stretches where it will be necessary to change the location if the alinement and grade are to be brought to standard, but as a means of providing safety and of conserving the work that has been done at these places it is thought advisable to improve the alinement by widening the roadway and allow the grades to be slightly increased, rather than change the entire location.

Excessive curvature is also found over the sabanas near Anton. This would at first glance appear unnecessary, but upon examination it will be seen that the terrain is broken by many deep ravines (arroyos) caused by erosion and they usually occur with almost perpendicular banks. It was found advisable to deviate from a direct alinement in order to secure economical crossings of these deep gullies. Sight distances throughout this section are ample and the road can be made much safer by simply widening the sharper curves.

The general alinement of a road built along the reconnoitered route from El Hato to the Panama-Costa Rican boundary, where no construction work has been done, should prove satisfactory.

The easterly approach to the controlling bridge site on the Rio Chiriqui Viejo will involve about 1¼ miles (2 kilometers) of heavy work and it will be difficult along this section to adhere to alinement standards without a great deal of cost. The westerly approach will not involve excessive curvature but will necessitate heavy earthwork, additional width of roadway for safety, and sections of retaining wall to prevent slides.

Beside the above-mentioned crossing of the Rio Chiriqui Viejo, which is the most costly and difficult section of the highway in Panama to construct, there are the crossings of the Rios Barriles, Rabo Gallo, Chepo, Guizado, and Piedra Candela which present no particularly difficult problems.

Gradients.—The grades on that section of the existing Central Highway of Panama from Panama City to El Hato are satisfactory, the maximum being 7 percent. It is thought advisable in the future to introduce short sections of 8- or 9-percent grades in order to improve, without excessive cost, the alinement at points mentioned heretofore.

The maximum grade from El Hato to the Panama-Costa Rica boundary line should be held to the recommended standard which is readily possible considering

the topography of the terrain through which the route lies.

Mountains and valleys.—Since the route parallels the Pacific coast practically from Panama City to Concepcion, there are no ridges or valleys that can be followed for any great distance.

The higher ridges crossed are spurs jutting from the Continental Divide and are usually approached by taking advantage of small streams which have their sources in them, and not by developing along the slopes of the ridge itself. The same principle applies to the streams that are crossed. These are usually approached along one of their tributaries, and are seldom followed for long distances. From Concepcion to El Hato is the longest section of ridge construction. The line here follows for the entire distance along a spur extending out from the Volcano of Chiriqui.

The elevations of the ridges crossed are shown on the plan and profile sheets.

Principal drainage.—Reference has already been made to the fact that the route crosses those streams that have their origin in the Continental Divide and flow to the Pacific Ocean.

Bridges on the Central Highway of Panama, of greater span than 56 feet (17 meters) are with few exceptions of steel construction with concrete substructures. They are of various types: Pony truss, through truss, deck truss, and suspension. In most instances they were designed for one-way traffic, exceptions to this being at places where they occur at the intersection of two grades descending to the bridge, at which points two-way traffic is provided as a safety precaution.

Small bridges are of concrete, flat slab, or I-beam and slab types. Culverts are of corrugated metal pipe and concrete.

The clear openings provided over all waterways are ample for ordinary flood conditions. Some of the crossings of the larger streams have been provided with a main bridge and several relief spans.

The substructures for bridges are constructed on rock foundations or, where this is not economically possible, they are on gravel or pile foundations.

Some idea of the structures necessary on a road paralleling the Continental Divide may be had from the fact that there are 90 steel bridges already constructed or provided for, varying from 50 to 560 feet (15.2 to 171 m) in length between the Panama Canal and David, a distance of 301.8 miles (495.8 km).

Table 11 gives a complete list of steel bridges designated by the name of stream crossed on the route.

TABLE 11.—Steel bridges along the route of the inter-American highway

River	Length of span		Type of truss	One or two way
	Feet	Meters		
Aguacate.....	130	39.6	Through.....	Two.
Bernardino.....	65	19.6	do.....	Two.
Caimito.....	130	39.6	do.....	Two.
Perdiz.....	65	19.6	do.....	Two.
Vaca Monte.....	65	19.6	do.....	One.
Perequete.....	100	30.4	do.....	One.
Capira.....	80	24.4	do.....	One.
Camaron.....	50	15.2	do.....	One.
Sajalises.....	100	30.4	do.....	One.
La Mona.....	100	30.4	do.....	One.
Lagarto.....	100	30.4	do.....	One.
Bejuco.....	100	30.4	do.....	One.
Charme.....	(1)	48.4	do.....	One.
Lajas.....	(2)	54.7	Deck.....	One.
Tetita.....	158	48.2	do.....	One.
Teta.....	206	62.7	do.....	One.
Matahogada.....	130	39.6	do.....	One.
Calabazo.....	138	42.1	do.....	One.
Corona.....	100	30.4	Through.....	One.
Coton.....	216	65.8	Deck.....	One.
Agallal.....	135	41.2	do.....	One.
Las Guías.....	163	49.7	do.....	One.
Platanal.....	100	30.4	Through.....	One.
Mahagual.....	115	35.0	Deck.....	One.
La Mona.....	(3)	24.4	do.....	One.
Patino.....	65	19.6	Through.....	One.
Farallon.....	150	45.7	do.....	One.
Rio Hato.....	130	39.6	do.....	One.
Rio Chico.....	168	51.2	do.....	One.
Rio Anton (relief).....	100	30.4	do.....	One.
Rio Anton.....	130	39.6	do.....	One.
Guabas.....	130	39.6	do.....	One.
Estancia.....	180	54.7	do.....	One.
Juan Diaz.....	130	39.6	do.....	One.
Chorrera.....	180	54.7	do.....	One.
Rio Hondo.....	100	30.4	do.....	One.
Cocle.....	(4)	51.2	do.....	One.
Cocle (relief).....	65	19.6	do.....	One.
Barrero.....	65	19.6	do.....	One.
Herradura.....	100	30.4	do.....	One.
Rio Grande (relief).....	100	30.4	do.....	One.
Rio Grande.....	(5)	39.2	do.....	One.
Mojapollo.....	65	19.6	do.....	One.
Salobre.....	65	19.6	do.....	One.
Cano.....	168	51.2	do.....	One.
Chirube.....	180	54.7	do.....	One.
Chico.....	150	45.7	do.....	One.
Estero Salado.....	100	30.4	do.....	One.
Santa Maria.....	(6)	15.8	do.....	One.
Conaca.....	100	30.4	do.....	One.
Chorros.....	80	24.4	do.....	One.
San Pedro.....	190	57.8	do.....	One.
Aclita.....	190	57.8	do.....	One.
Santa Barbara.....	80	24.4	do.....	One.
Mamei.....	100	30.4	do.....	One.
Maranon.....	80	24.4	do.....	One.
San Pablo.....	540	164.3	Suspension.....	One.
Tribique.....	130	39.6	Through.....	One.
Tobalico.....	100	30.4	do.....	One.
Sapotillo.....	130	39.6	do.....	One.
Sebastiana.....	50	15.2	do.....	One.
Jorones.....	100	30.4	do.....	One.
Vidal.....	130	39.6	do.....	One.
Salado.....	80	24.4	do.....	One.
Tabasara.....	450	137.2	Suspension.....	One.
Tinta.....	80	24.4	Through.....	One.
Jaguo.....	65	19.6	do.....	One.
Ule.....	80	24.4	do.....	One.
Chacarero.....	65	19.6	do.....	One.
Jacube.....	80	24.4	do.....	One.
Santiago.....	260	79.3	do.....	One.
Salado.....	100	30.4	do.....	One.
Santa Lucia.....	130	39.6	do.....	One.
Honda.....	100	30.4	do.....	One.
San Felix.....	320	97.5	do.....	One.
Dupi.....	130	39.6	do.....	One.
Galique.....	80	24.4	do.....	One.
Juay.....	130	39.6	do.....	One.
San Juan.....	280	85.3	do.....	One.
Fonseca.....	(7)	48.8	Suspension.....	One.
Estero Ajo.....	130	39.6	Through.....	One.
Corrales.....	130	39.6	do.....	One.
Madronal.....	50	15.2	do.....	One.

Footnotes at end of table.

TABLE 11.—*Steel bridges along the route of the inter-American highway—Continued*

River	Length of span		Type of truss	One or two way
	Feet	Meters		
Estero Salado.....	80	24.4	Through.....	One.
Las Vueltas.....	65	19.6do.....	One.
Chorchita.....	65	19.6do.....	One.
La Pita.....	65	19.6do.....	One.
Chorcha.....	180	54.7do.....	One.
Chiriqui.....	⁸ 560	171.0	Suspension.....	One.
Risacua.....	180	54.7	Through.....	One.

¹ Two 80-foot approaches, one center 180-foot span.² One 33-foot I-beam approach, one 30-foot span.³ Two I-beam approaches, one 80-foot span.⁴ Two of 168.⁵ Two 65-foot approaches, one 205-foot span.⁶ One 52-foot approach, one 70-foot approach, one 183-foot span.⁷ Two 80-foot approaches, one 400-foot span.⁸ New.

Soil conditions.—Soil conditions encountered along the route of the highway in Panama are quite varied, but usually are such as will provide adequate foundations for road surfacing. Along the plains and sabanas is found a soil composed largely of loam and fine sand. This usually absorbs moisture very readily unless the percentage of loam is greatly in excess of that of sand, in which case it becomes almost miry after rains that last for some time. It is, however, very firm when kept dry. In the lower foothills are found rock, shale, and clay with the clay predominating. Such materials seem to provide stable foundations for road surfacing and prove very satisfactory when well drained.

In higher altitudes, particularly in forested areas, is found a topsoil which varies from 2 to 10 feet in depth and is composed of decayed vegetable matter. It is not recommended for use as a foundation for surfacing on account of its instability and springiness. Where such material is encountered it seems advisable that it be removed and placed in fills along with other materials of a more stable character.

Materials.—Materials for surfacing and concrete aggregate are found locally only in limited quantities. The volcanic sand which is obtainable in large quantities on the Llanos del Volcan and throughout the streambeds and canyon walls of the Rio Chiriqui Viejo will serve in combination with coarser materials as a fairly good surfacing material.

It is very probable that use will have to be made of the large volcanic boulders which are found on the Llanos del Volcan and along the Rio Barriles, also of the larger stones that are found in some of the streambeds, principally the Chiriqui Viejo. These materials can be crushed or hand broken for use as road metal, but this will prove costly as they are not massed in large quantities, in any one place.

It is expected that during the grading operations some materials will be uncovered that might be usable for surfacing, but these are not in evidence at present. Only occasionally are found signs of underlying rock strata and usually these are very much decomposed. As a deep mat of leaf mold and dense jungle growth covers most of the area it is rather difficult without extensive investigation to determine the underlying formations. However, in an area where such precipitous slopes occur it seems reasonably certain that there is some stable material beneath the surface, but to what depth is conjectural.

The volcanic sand mentioned before may be used for the fine aggregate in concrete. It will have to be thoroughly washed and graded, which will prove costly as the yield of suitable material will be low.

The region is well forested except on the Llanos del Volcan where the growth of large trees is very limited. Sufficient timber will be found for such purposes as may be needed. In table 12 is given a list of available native woods with their principal characteristics.

TABLE 12.—*Available construction timber in the Volcan area*

Name of wood	Characteristics
Carbonero.....	Very durable, hard, and proof against insects. Lasts over 25 years as bridge stringers.
Bambito (blanco and colorado).....	The second is good for building; the first resembles cottonwood and is subject to dry rot.
Sigua negro.....	Fine grain, medium-hard.
Sigua canela.....	Do.
Sigua amarillo.....	Do.
Maria.....	Do.
Guayava (lowland).....	Plentiful, but small and costly to mill.
Blanco (guayava) ¹	Very hard, but scarce and costly to mill.
Wild rubber.....	Do.
Copal.....	Do.
Pizarra.....	Fine grain, medium-hard.
Cedro ¹	Not plentiful; characteristics resemble American cedar.

¹ Cabinet woods.

Estimates of cost.—Tables 13, 14, and 15 itemize the estimated costs on the principal phases of the operations in Panama.

Estimates for type 1, table 13, contemplate an all-weather road from Panama City to the Panama-Costa Rican line, a total distance of 367.1 miles (590.8 km) as follows:

- 250 miles (402.3 km) on the Central Highway of Panama with a graded section of 20 to 30 feet and a surface of 12 to 18 feet in width.
- 40 miles (64.4 km) of new construction, a 28-foot graded section and a surface 18 feet wide of local material compacted to 6 inches.
- 77.1 miles (124.1 km) on which additional grading and surfacing is necessary.

367.1 miles (590.8 km) total length of the Central Highway of Panama.

Estimates for type 2, table 14, contemplate the following work on the Central Highway of Panama to bring it to a 28-foot graded section and an oiled surface 18 feet wide with a compacted thickness of 6 inches of local material:

- 9 miles (14.5 km) from Panama to Arraijan, no work necessary.
 241 miles (387.8 km), grade and surface to be widened from 20-24 feet and 12-18 feet to 28 and 18 feet, respectively.
 77.1 miles (124.1 km) to be widened and completely surfaced.
 40 miles (64.4 km) of new construction.
 367.1 miles (590.8 km) total length of the Central Highway of Panama.

All bridges are to be widened to a 20-foot roadway or another single-track bridge at each site built.

TABLE 13.—*Estimates for type 1*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing	40	Miles	\$1,200	\$48,000
Unclassified excavation	600,000	Cubic yards	1	600,000
Small drains	40,000	Linear feet	7	280,000
Bridges	1,550	do	125	193,750
Surfacing	274,950	Cubic yards	3	824,850
Total				1,946,600
Add 10 percent for engineering and contingency				194,660
Total estimate				2,141,260

TABLE 14.—*Estimates for type 2*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing	40	Miles	\$1,200.00	\$48,000.00
Unclassified excavation	1,400,000	Cubic yards	1.00	1,400,000.00
Small drains	66,400	Linear feet	10.00	664,000.00
Bridges	15,490	do	125.00	1,936,250.00
Surfacing	470,000	Cubic yards	3.00	1,410,000.00
Oil	1,890,768	Gallons	.20	378,153.60
Total				5,836,403.60
Add 10 percent for engineering and contingency				583,640.36
Total estimate				6,420,043.96

Estimates for type 3, table 15, contemplate the following work on the Central Highway of Panama to

bring it to a 32-foot graded section and place an 8-inch thick concrete pavement 20 feet wide:

- 9 miles (14.5 km), no work necessary.
 241 miles (387.8 km) to be paved, graded section to be widened from 20 to 32 feet.
 77.1 miles (124.1 km) to be paved, and graded section widened from 18-20 feet to 32 feet.
 40 miles (64.4 km) of new construction.

367.1 miles (590.8 km) total length of the Central Highway of Panama.

The widening of bridges to a 20-foot roadway, or building another single-track bridge at each site, and the lengthening of small drainage structures is contemplated.

Principal stream crossings in Panama are shown in table 16 and the length of span is indicated for bridges not yet constructed.

TABLE 15.—*Estimates for type 3*

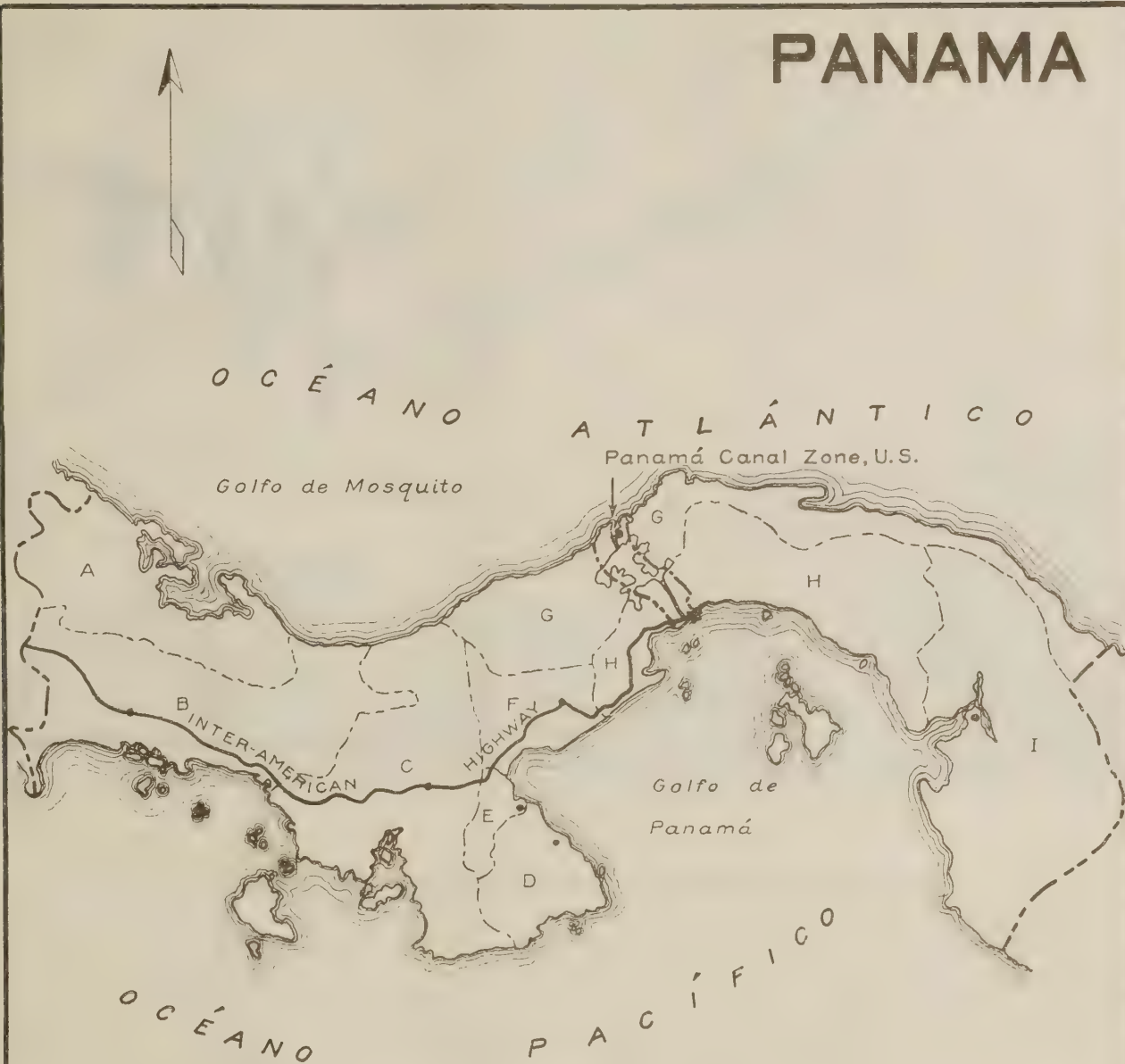
Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing	40	Miles	\$1,200	\$48,000.00
Unclassified excavation	1,700,000	Cubic yards	1	1,700,000.00
Small drains	79,600	Linear feet	10	796,000.00
Bridges	15,490	do	125	1,936,250.00
Concrete	933,560	Cubic yards	15	14,003,400.00
Total				18,483,650.00
Add 5 percent for engineering and contingency				924,182.50
Total estimate				19,407,832.50

TABLE 16.—*Principal stream crossings*¹

Name of stream	Length of bridge span	
	Feet	Meters
Rio La Cristobal	80	24
Quebrada Las Adjuntas	80	24
Rio Platanar	120	37
Rio Balsas	100	30
Rio Chirigagua	140	43
Rio Cairito	100	30
Rio Piedra o Chico	200	61
Brazo de Piedra	80	24
Rio Mula	120	37
Rio Barriles	60	18
Quebrada Chiquero	40	12
Rio Chiriqui Viejo	150	46
Rio Rabo Gallo	70	21
Rio Chepo	70	21
Rio Guizado	70	21
Rio Piedra Candela	70	21
Total	1,550	470

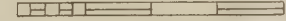
¹ All these locations are between David and the Costa Rica line.

PANAMA

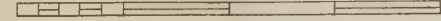


ESCALA

25 0 25 50 75 KILÓMETROS



25 0 25 50 75 MILLAS



DEPARTAMENTO	CAPITAL
A BOCAS DEL TORO	BOCAS DEL TORO
B CHIRIQUÍ	DAVÍD
C VERAGUAS	SANTIAGO
D LOS SANTOS	LAS TABLAS
E HERRERA	CHITRÉ
F COCLE	PENONOMÉ
G COLÓN	COLÓN
H PANAMÁ	PANAMÁ
I DARIÉN	LA PALMA

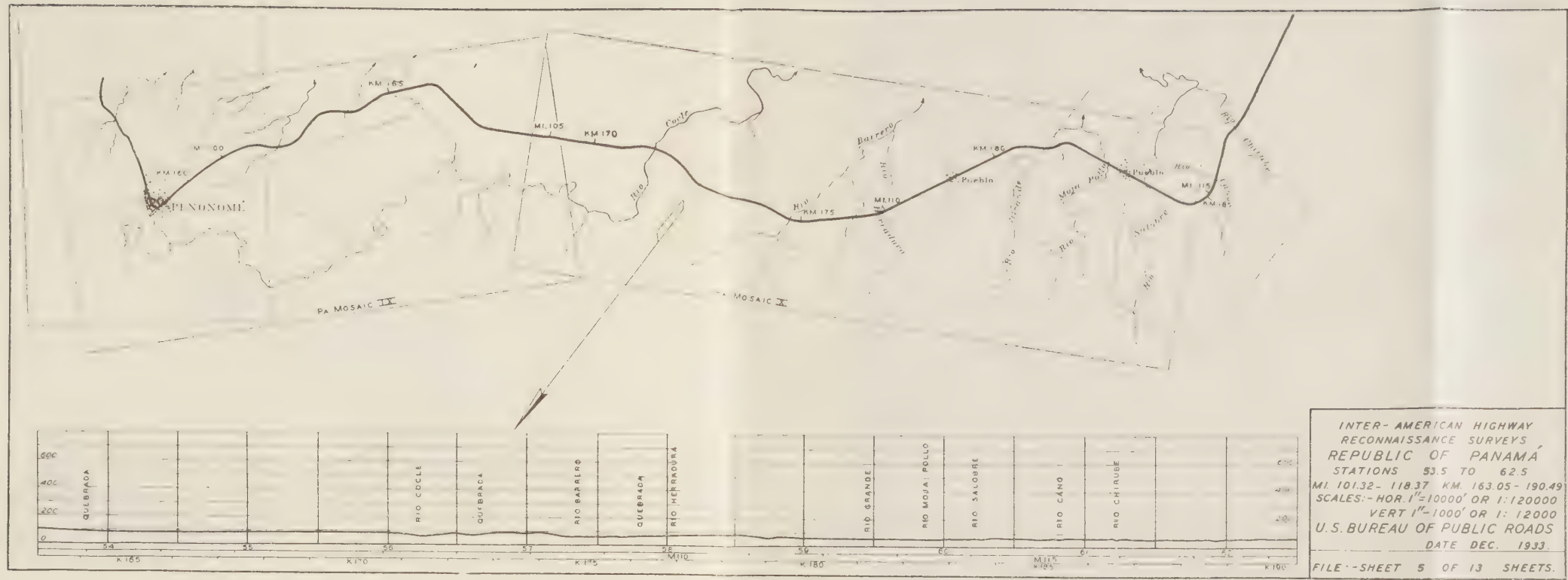


PLATE 8.

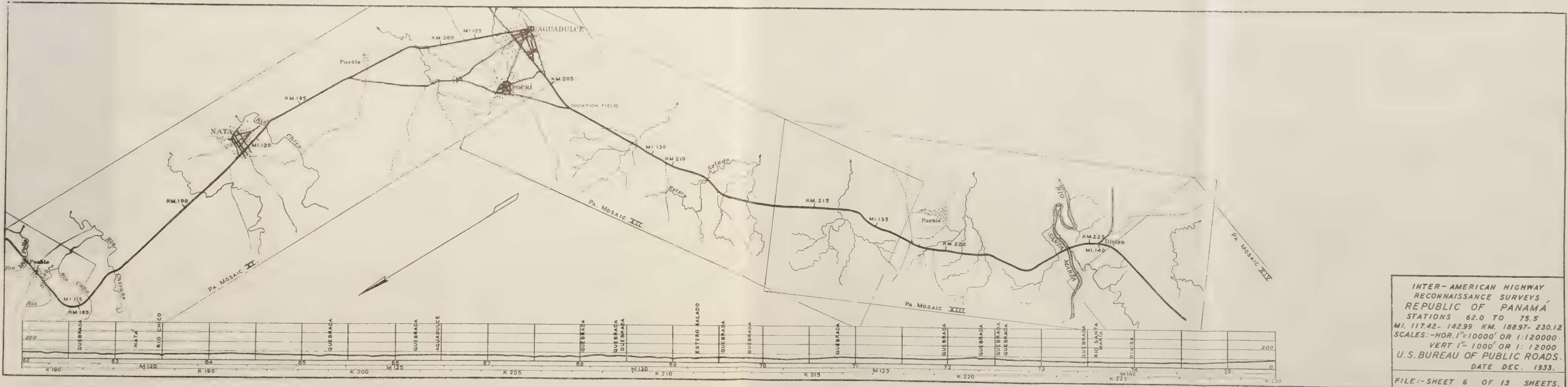


PLATE 9.



PLATE 10.

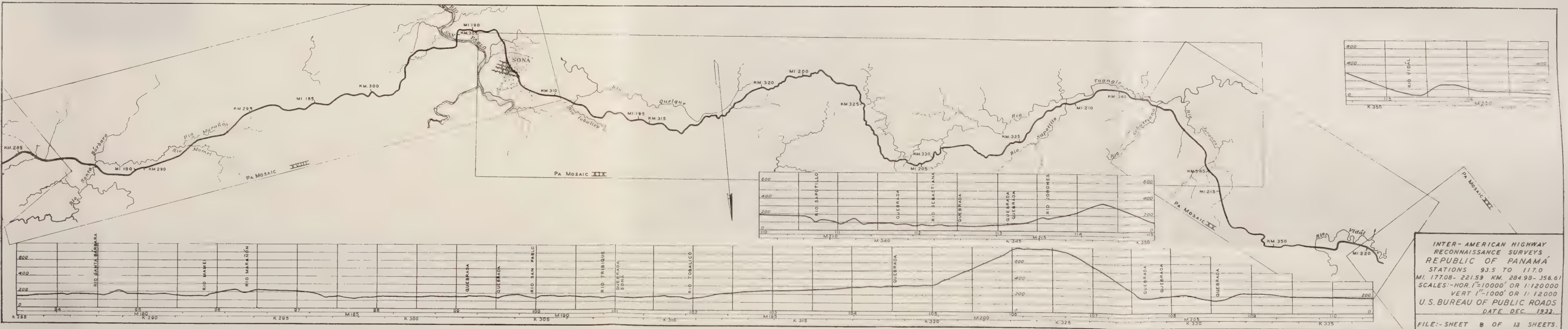


PLATE 11.



PLATE 12.



PLATE 13.

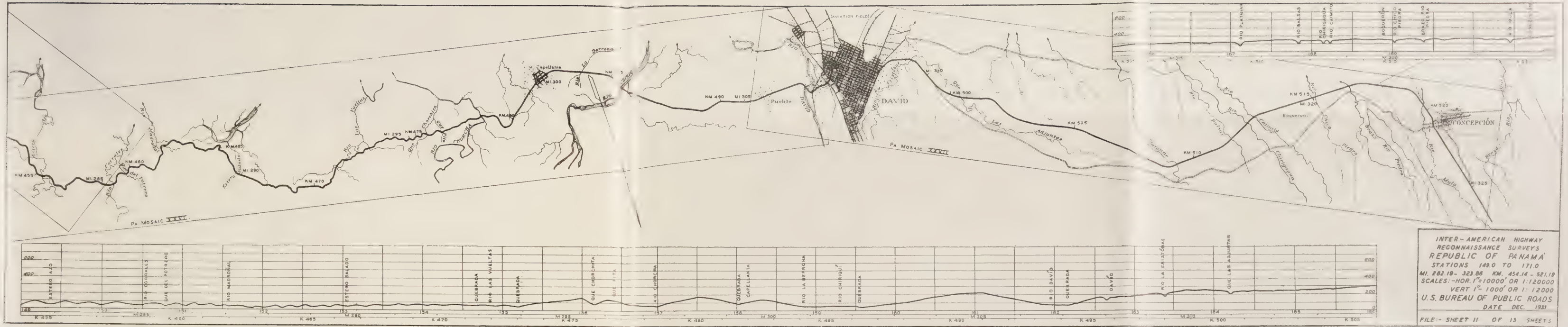


PLATE 14.

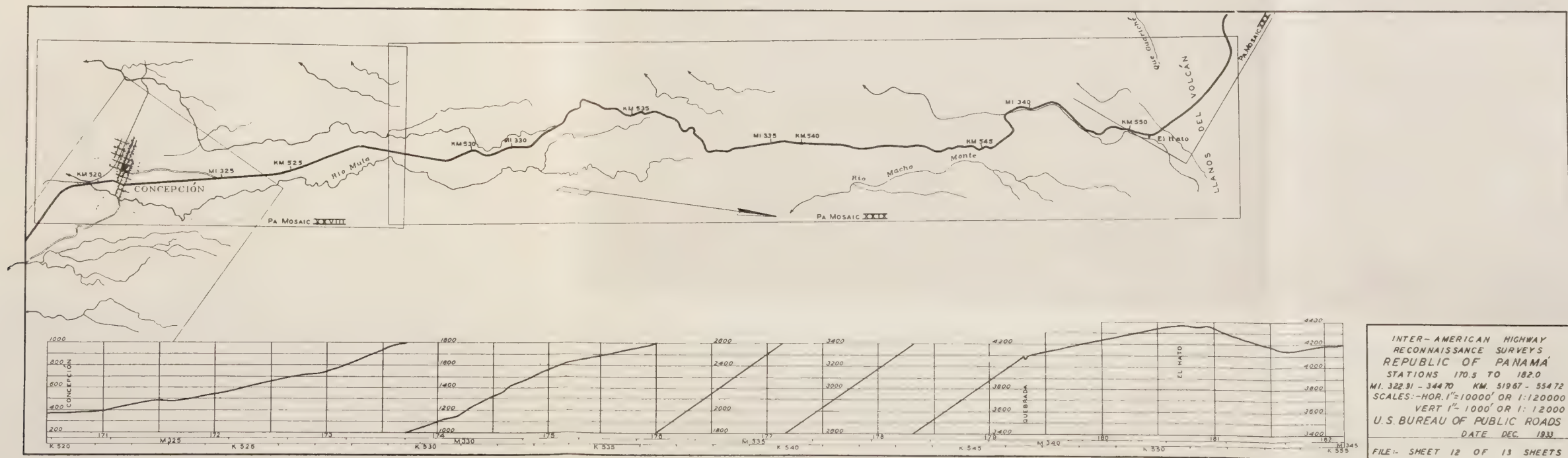


PLATE 15.

PLATE 16.

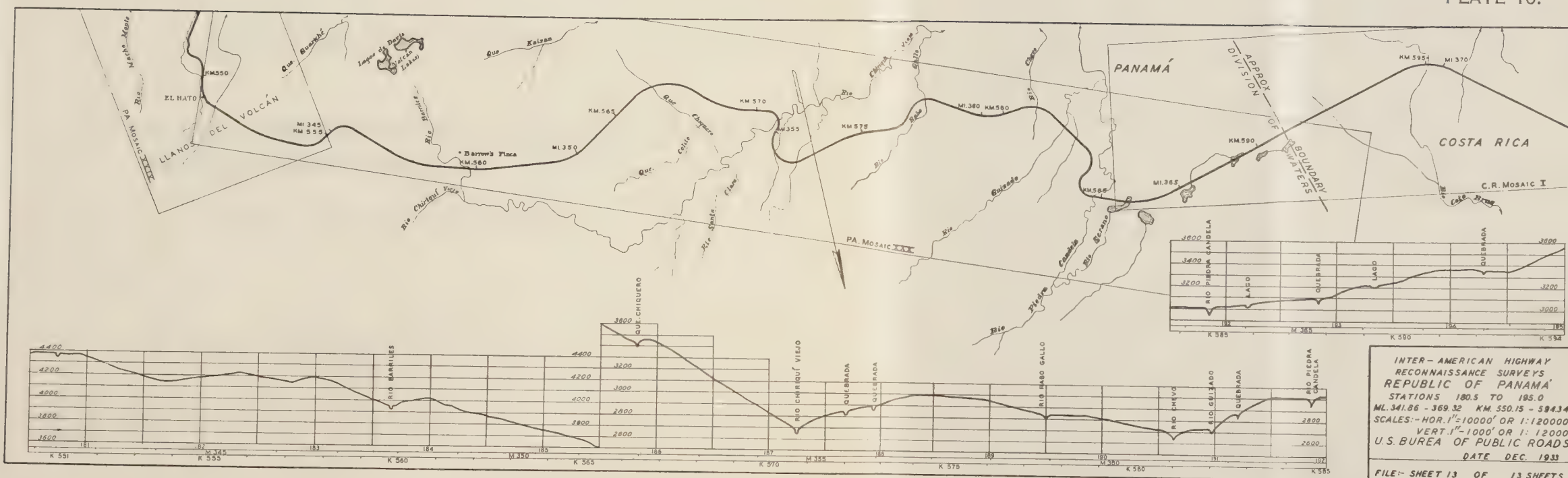


PLATE 16.

PROPOSED INTER-AMERICAN HIGHWAY

REPORT OF A RECONNAISSANCE SURVEY FOR THE
PROPOSED INTER-AMERICAN HIGHWAY

PART III.—REPUBLIC OF COSTA RICA

BUREAU OF PUBLIC ROADS
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

COSTA RICA

GENERAL SECTION

HISTORY

Costa Rica (Rich Coast) was so named by Columbus in the year 1502 on his fourth and last voyage to the New World, but it was not until 1564 that a permanent settlement was made, at Cartago. In 1565 the first governor was appointed by the Spanish Crown, and the country was made a part of New Spain with governmental administration centered at Guatemala. Costa Rica declared its independence from Spain on September 15, 1821, and was a party to the Central American Federation of 1824-25, but withdrew in 1838. In 1844 the first constitution was adopted. This was followed by a second organic law in 1847 and this lasted until 1871 when it was revised and readopted. The constitution of 1871, with few modifications, exists at present. Costa Rica declined the invitation of the delegates who met in Leon, Nicaragua, in 1849, to join the Central American Confederation and also opposed the attempt in 1885 of President Barrios, of Guatemala, to reestablish the Central American Confederation by proclamation. When in 1898, Honduras, Nicaragua, and El Salvador signed at Managua, Nicaragua, a constitution for the United States of Central America, provision was made for the admission of Costa Rica, but this federative movement collapsed in 1899. Costa Rica signed the "Treaty of Union" of the Federation of Central America, adopted in San Jose in 1921, but the congress rejected the covenant by a close vote.

To this day the citizens of Costa Rica display many of the characteristics of the virile race which at one time ruled a large part of the civilized world. As a result of conquest in earlier and revolution and internal strife in later years, Costa Rica, like most of the countries of the New World, suffered the loss or destruction of many artistic objects, a great deal of bijoutry and records of historical value. Evidences of the handicraft of the aborigines still exist in a wealth of pottery, clay, stone idols, "huacas" (ancient Indian tombs) of gold, silver, and copper, and other artifacts. Specimens of these are to be found in the museum of San Jose and frequently in Indian burial places scattered throughout the country, testifying to a pre-Columbian civilization of no mean order.

GEOGRAPHY, TOPOGRAPHY, AND AREA

Costa Rica is the smallest republic in Central America with the exception of El Salvador, its area being estimated at 23,000 square miles (59,300 square

kilometers). It is bounded on the north by Nicaragua, on the east by the Atlantic Ocean and Panama and on the south and west by the Pacific Ocean. It lies wholly within north latitudes 8° and $11^{\circ}30'$, and west longitudes 82° and 86° .

The country is largely mountainous. The Continental Divide extends entirely through it from northwest to southeast and in this range of mountains are found numerous peaks, a number of which are active or inactive volcanoes, some of them reaching an altitude of over 10,000 feet (3,500 meters). The principal volcanoes are Irazu, Poas, Iscazu, Carpintera, Orosi, Tenorio, Miravalles, Herradura, Barba, and Turrialba.

Many streams have their sources in the mountains of the interior. Along their upper reaches will be found much broken and rugged country, extending in some sections practically to the seacoast, in others blending into coastal plains along the Atlantic and Pacific seaboard. The principal streams flowing into the Atlantic Ocean are the San Carlos and Sarapiquí through the San Juan and the Reventazon, Matina, Estrella, Tarire, and Teraria. Those flowing into the Pacific Ocean are the Tempisque, Guacimal, Barranca, Tarcoles, Pirris (Parrita), Savegre, and Diquis (Rio Grande de Terraba).

On both sides of the Continental Divide and near the coasts is found much fertile and productive land. Practically midway between the northern and southern boundary of the country and extending across the Continental Divide is found a rolling section of very productive land known as the "Meseta Central" (Central Plain). It varies in elevation from 3,000 to over 5,000 feet (915 to over 1,525 meters), covers an area of approximately 3,500 square miles (9,070 square kilometers), lies both on the Atlantic and Pacific slopes, is of volcanic origin, and is essentially adaptable to the cultivation of coffee although there may be found here almost any of the crops, fruits, and vegetables of the temperate zones.

This upland area is crossed in its longest direction by the proposed location of the inter-American highway and both in reaching and leaving this region the route is located to take advantage of several outlying areas capable of cultivation and development.

Large sections of the country are rendered useless for agricultural purposes on account of the steepness of the terrain and will probably erode very rapidly if they are ever deforested. However, this does not apply to any single, large area, because stable and productive land is usually found along the streams and often on

the summits of the larger mountains, while frequently along spurs and ridges there are areas of varying sizes that are highly adaptable to cultivation.

CLIMATE AND RAINFALL

The temperature of Costa Rica is essentially that of the Tropics, but varies considerably between the several sections of the country on account of differences in altitude. Along the coasts the heat is frequently very oppressive, often reaching 100° F.; in the higher elevations the thermometer sometimes approaches the freezing point; and between these two extremes almost any temperature desired may be found.

The year is divided into two seasons, designated "wet" and "dry." The former usually extends from June to November, inclusive, and the latter throughout the remaining months of the year. During the dry season there is scarcely any rain, but during the wet season it is a daily occurrence. Usually the rains begin about midday, continue until late afternoon or into the night, and are at times of torrential intensity. The Atlantic slope of the Continental Divide has considerably more and heavier rainfall than the Pacific slope. The rainfall for a year on the Atlantic side averages about 220 inches (560 centimeters), while on the Pacific side it is about 100 inches (250 centimeters). The Meseta Central enjoys an average annual rainfall of about 75 inches (200 centimeters), and this is a fair average for regions at this altitude but is probably somewhat exceeded in the highest mountains.

POPULATION

The official estimate of population of Costa Rica for 1930 gave 516,031 inhabitants, distributed by Provinces, as shown in table 1. The population of principal cities is given in table 2.

TABLE 1.—*Population by Provinces in 1930*

Province	Area ¹		Population
	Square miles	Square kilometers	
San Jose.....	2,300	5,957	167,669
Alajuela.....	4,300	11,137	107,285
Cartago.....	1,500	3,885	77,626
Heredia.....	1,900	4,921	41,697
Guanacaste.....	5,000	12,950	57,045
Limon.....	3,900	10,101	33,382
Puntarenas.....	4,300	11,137	31,327
Total.....	23,200	60,088	516,031

¹ Approximated.

TABLE 2.—*Population of principal cities ¹*

San Jose.....	54,705
Alajuela.....	9,266
Heredia.....	8,091
Cartago.....	7,425
Liberia.....	3,510
Puntarenas.....	7,559
Limon.....	15,841
Grecia.....	² 2,500
Total.....	108,897

¹ From Elections Laws for 1931 (Hector Beeche).

² Estimated.

It is estimated that 75 percent of the population dwells on the Meseta Central, approximately 3,500 square miles (9,070 square kilometers) of territory lying at an altitude of over 3,000 feet (915 meters) and extending in a northwesterly direction from Cartago. About 80 percent of the total population is of European descent, principally from Andalucia and Galicia, Spain. Approximately 80 percent of the population may be classified as rural. Figures as to the number engaged in agriculture and stock raising are not available, but the great bulk of the population derives its living directly from the soil and 96 percent of Costa Rican exports is agricultural. The number engaged in mining is unappreciable.

ECONOMIC SECTION

National wealth.—In order that data may be available for comparisons with other countries of Central America, and to furnish a background for financial consideration of the ambitious project contemplated by the survey, an effort has been made to determine the net wealth of Costa Rica.

The gross wealth of Costa Rica is shown in table 3 and the debt, as of 1932, in table 4.

TABLE 3.—*Gross wealth*

Source:

Cultivated lands and improvements.....	\$48,500,000
Grazing lands, sown and natural.....	12,000,000
Uncultivated lands, public and private.....	30,000,000
Forests and lumber equipment.....	7,500,000
Mineral deposits and mining developments...	5,500,000
Urban land and improvements.....	40,000,000
Livestock and annual crops.....	42,000,000
Currency reserve.....	1,000,000
Government property, including Pacific R.R., banks, public buildings, etc.....	31,500,000
Total.....	218,000,000

TABLE 4.—*Debt as of 1932*

Type:

External, funded.....	\$20,948,500
Internal, funded.....	2,138,200
Floating.....	5,601,000
Total.....	28,687,700

This gives a net wealth of Costa Rica (gross wealth minus the external and floating debt—the internal funded debt is held in the country) of about \$191,500,000, or a per capita of \$371. Foreign investments other than the public debt are estimated to be approximately \$48,000,000, leaving a net wealth to the Costa Rican people proper of \$143,500,000, or a per capita of \$278.

No claim of accuracy is made with respect to the above estimated figures. They are the closest approximations possible with the limited data available. In each instance they have been arrived at only after consultation with foreigners or natives acquainted

with conditions in their respective activities. Round numbers are used.

The total for "Cultivated lands and improvements" is reached by giving a value of \$120 an acre for coffee land in production (total, \$15,000,000); for cacao lands, \$100 (\$14,000,000); for banana lands, \$100 (\$7,500,000); for sugar lands, \$60 (\$1,800,000); for sown pasture, which calls for clearing and plowing, \$50 (\$10,000,000); for natural pasture, \$5 (\$1,700,000); for all other cultivated lands, and those not reported, \$35 (\$10,500,000).

Uncultivated private lands, estimated at 8,000,000 acres, and doubtless including the best land of this class, are given an average value of \$2.50 an acre; public lands, about 5,000,000 acres, are averaged at \$2; total, \$30,000,000.

Forests and lumbering equipment (stumpage values, et cetera) are arbitrarily fixed. The same is true of mineral deposits and mining and largely true of urban land and improvements.

Livestock and annual crops valuation is approximated by giving a flat rate of \$10 a head to all cattle, horses, mules, and donkeys (aggregating 491,477 head); \$3 a head for pigs, goats, and sheep (aggregating 85,467 head); and 25 cents each for domesticated fowls. Average annual exports are \$18,000,000 and on the authority of Senor Fernando Castro, leading Costa Rican capitalist and lumberman, the annual consumption by the inhabitants of agricultural products domestically produced is about \$20,000,000.

The valuation of government property, et cetera, is based on a recent estimate of the head of Tributación Directa (Direct Tax Bureau).

National income.—Normally, national income is estimated at approximately \$46,000,000 a year. On the Meseta Central with its population of 376,000, where four-fifths of the merchandising takes place, where most of the manufacturing is done, where the wealthy hacendados reside, and where a large number of women are enrolled in gainful occupations, the annual income is reckoned at \$100 per capita. The Costa Rican people, as a whole, enjoy a standard of living relatively high for a tropical country and in this respect rank among the highest of the Central American republics. This is due, of course, to the relatively high economic development of the country. Off the Meseta Central it is estimated that \$60 per capita as the average annual income of those 140,000 inhabitants is fairly accurate. This would yield a per capita income for the entire population of nearly \$90 per annum. This includes the value of consumed, domestically produced foodstuffs as well as currency. Probably \$38 of this income goes for domestic, and between \$7 and \$8 for imported, foods.

Employment and wages.—In general it may be said that wages in Costa Rica range from 50 cents a day for unskilled, to \$1.50 and \$2 for skilled, labor. A

few good machinists and road machinery operators have been paid as high as \$2.50. Servants receive from \$12 to \$25 a month, with food and lodging. Urban workers are paid at a higher scale than those in rural districts, and laborers receiving the low common wage of 50 to 75 cents a day usually, if not indeed customarily, receive also their subsistence and sometimes, if employed in agriculture, house and use of a small plot of land.

PRODUCTS AND INDUSTRIES

Agriculture.—Statistics on cultivation and agriculture in Costa Rica must be accepted with caution. In the "Statistical Annual" of Costa Rica for 1929 the director general of statistics presents a table of cultivated lands. He mentions as his sources of information "the political authorities of the republic", that is to say, "governors, political chiefs, and police agents".¹

Figures regarding cultivable areas in the Annual are estimated only. None are made without some basis. Some are made as a result of personal observation and consultation with many individuals who have traveled the territory. There is a dearth of national statistics; those concerning total coffee cultivation and production are so uncertain that the Costa Rican National Association of Coffee Producers in 1929 recommended the organization of a general coffee census to be undertaken by experts as the best method of securing authentic data. Table 5, showing the acreage under cultivation, embraces the years from 1922 to 1929. Accepting the figures as the best available and using the first and last years, we have the following:

TABLE 5.—Acreage under cultivation in 1922 and 1929

Product	Year	
	1922	1929
	<i>Acres</i> ¹	<i>Acres</i> ¹
Coffee.....	65,767	128,525
Sugarcane.....	43,640	30,326
Beans.....	17,085	24,365
Corn.....	71,712	83,905
Plantain.....	17,810	Unlisted.
Bananas.....	76,047	75,565
Rice.....	15,232	13,845
Yuca.....	2,595	3,047
Potatoes.....	8,047	4,127
Tobacco.....	3,305	2,832
Cacao.....	31,633	140,940
Rubber.....	3,645	222
Forage:		
Cultivated.....	273,380	201,347
Uncultivated.....	258,515	359,812
Garden truck.....	2,667	1,672
Miscellaneous.....	4,535	1,557
Total.....	895,615	1,052,087

¹ 2½ acres approximate 1 hectare.

Coffee.—From these figures it would appear that the acreage devoted to coffee increased by 96 percent during the 8-year period in question. As previously remarked, coffee statistics are uncertain. The Na-

¹ P. 21, Statistical Annual, 1929.

tional Association of Producers, on the basis of the 1928 exportation of about 18,842 metric tons, plus an assumed annual per capita consumption of 10 pounds, estimated total production for that year as nearly 46,000,000 pounds. There was a 10-percent increase in exportation the following year. But, while 1928 exports brought \$12,379,558, or an average of about \$31.37 per hundred pounds, 1929 exports brought \$12,225,718, or an average of \$29.55. With an exportation set at nearly 52,000,000 pounds in 1930, the total received was \$10,419,000. This is 6,000,000 pounds greater than total production as estimated for 1929. About 65 percent of the country's exports normally consists of coffee.

According to the statistical report for 1930, the areas of origin of this export coffee were as shown in table 6.

TABLE 6.—Percent by provinces of origin of coffee exportation

San Jose.....	41. 52
Alajuela.....	10. 01
Cartago.....	12. 25
Heredia.....	23. 56
Guanacaste.....	. 34
Limon.....	12. 32

Roughly, about 75 percent cleared through Limon and 25 percent through Puntarenas. Great Britain took 72 percent; Germany, 14 percent; and the United States, 11 percent. The heaviest exportation takes place in the months of January and February, when nearly 50 percent of the total is shipped.

United States purchases of Costa Rican coffee in 1930 were somewhat greater than in the 2 previous years, but we are still far from being the chief customer despite our high living standards. The reason given is that Costa Rican coffee is a quality coffee, always commanding a relatively high price in the world market, while American coffee drinkers show a preference for blends wherein the cheaper Brazilian coffees run in some instances as high as 90 percent.

The proposed line of the highway passes through five of the six coffee-producing Provinces and touches the principal cities in four.

Bananas.—Twenty-five percent of Costa Rican exports consists of bananas. The control of the banana industry is in the hands of a single American company, which pay relatively high wages, does its own shipping, and maintains its own commissary. The ownership by this company of the banana lands themselves is not at present as general in Costa Rica as in other banana-producing countries. It has been estimated that about 50 percent of the bananas shipped by the company from Costa Rica is produced on its own farms, the other 50 percent being purchased from native growers. The 1931 price paid growers per bunch was about 50 cents. Roughly, it would appear that of the total banana export for 1929, valued at nearly \$4,600,000, Costa Rican growers sold to the American com-

pany about 3,000,000 bunches, valued at \$2,300,000, the average export value per bunch that year being about 75 cents.

The banana industry will not be directly affected by the proposed highway in Costa Rica because the industry is almost entirely confined to lowlands of the Atlantic littoral.

Cacao.—A considerable fraction of the \$900,000 worth of cacao exported in 1930 was controlled by this same fruit company. As bananas succumb to the banana wilt, the lands have in some instances been planted to cacao—a business, by the way, that has of late been languishing.

Aside from coffee, bananas, and cacao, Costa Rican agriculture must rely on an extension of the system of highways before the country can become important in either the Central American or in the world market. As has been noted, Costa Rican coffee is a prime-quality product and will doubtless command relatively high prices as long as coffee holds its world-wide popularity. It has been estimated that there are 1,000,000 acres of land still available for coffee production and that half of this acreage is of sufficient elevation to produce a prime-grade berry. With the exception of a small amount of "Borbon", raised near San Ramon, practically all of the coffee is Arabica. Coffee is grown under shade, usually furnished by the guama tree, a legume which replenishes the soil with nitrogen.

Tobacco.—Highway transportation would go far toward hastening the development of the tobacco lands, particularly in the El General section. The chief tobacco sections at present are near Puriscal, San Ramon, and Turrialba. About 600,000 pounds of native stock are used annually by a local American company in the manufacture of native cigarettes. The possibilities of tobacco culture in the El General region merit further investigation.

Vegetables and fruits.—The proposed inter-American highway should place Costa Rica in a position to make very appreciable sales of vegetables and fruits to residents of the Panama Canal Zone and to ships traversing the Canal. Among the fruits which are found in abundance and are raised with little or no cultivation are the citrus varieties, avocados, anonas (custard apples), papayas, mangoes, guavas, and granadillas. Luscious blackberries grow profusely in the mountain sections. Grapes do well. Apples, peaches, and pears can be raised. In Costa Rica and throughout Central America there are large potentialities for pineapple production, particularly in the vicinity of Cartago.

Sugar, beans, corn, plantain, rice, yuca, and potatoes are all important factors of the national diet, and if the country had adequate communication facilities their distribution would be much simplified and the country could count on more uniform prices for these domestic products.

The following table 7 shows distribution of cultivated areas by provinces, omitting a number of districts which did not report.

TABLE 7.—*Distribution of cultivated areas in hectares, by Provinces, in 1929*

Crop	San Jose	Alajuela	Cartago	Heredia	Guanacaste	Puntarenas	Limon	Total
Coffee	18,191	9,997	13,770	7,808	1,035	423	186	51,410
Sugarcane	3,009	5,616	969	1,114	1,079	350	8	12,145
Bananas	65	1,266	5,469		246	630	22,550	30,226
Cacao	2				8	343	56,023	56,376
India rubber	42				6	1	40	89
Forage:								
Uncultivated	26,552	38,000	24,665	7,578	24,649	8,120	6,361	135,925
Cultivated	7,234	16,918	3,858	744	39,465	10,592	1,728	80,539
Rice	1,624	1,206	3	8	1,523	1,146	28	5,538
Beans	3,568	3,606	759	277	769	737	30	9,746
Corn	9,163	8,629	2,901	1,561	8,424	2,603	281	33,562
Potatoes	256	724	603	15	51	2		1,651
Yuca	123	475	133	23	96	198	171	1,219
Yams	13	122	174	75	27	43	153	607
Tobacco	648	437		1	12	35		1,133
Vegetables	182	268	134	47	30	4		669
Total	70,672	87,264	53,438	19,251	77,420	25,227	87,563	1,420,835

¹ Equal to approximately 1,050,000 acres, at 2½ acres to the hectare.

In his treatise on native plants of Costa Rica ² H. Pittier enumerates the following food plants that thrive in Costa Rica. Highway development would tend to make the country self-supporting in these products.

Grains: Wheat, rice, corn, beans, oats.

Roots and tubers: Yams, yuca, chayote, potatoes.

Green vegetables: Artichokes, eggplant, onions, garlic, leek, sorrel, celery, parsley, watercress, spinach, cucumbers, mustard greens, cowpeas, green peas, lettuce, turnips, beets, carrots, radishes, cantaloupes, watermelons, rhubarb, cabbages, tomatoes.

All these were seen thriving by the reconnaissance party while traversing Costa Rica during 1931.

The traveler in Latin America is impressed by the high consumption by the natives of meat, principally beef and pork, starches, fats and sweets, and the low consumption of green vegetables even in sections where nearly every variety can be grown. A diet so devoid of green stuffs must of necessity have a somewhat lethargic effect on the people and the easy distribution of vegetables and fruits should have a generally beneficial effect on the national health.

Pittier also lists in his treatise 8 indigenous forage grasses, 12 exotics, and nearly 100 medicinal plants capable of greater cultivation.

Among the fiber plants are henequen and pita; oleaginous plants include cacahuete, cocotero, coquito, and corozo nuts; gums and resins include coriolo, copal, guapinol, and cativa. There are two rope factories of considerable size in Costa Rica, one at Cartago and the other at San Ramon, which use principally henequen fiber.

Potential cultivation.—Since the total area of Costa Rica is 23,000 square miles (59,300 square kilometers), equal to 14,720,000 acres, it is evident that something more than 7 percent of the area is now in cultivation or pasture. A conservative estimate of total arable land in the country made by Germans, Americans,

and natives who are acquainted with the entire territory, and eliminating town and other similarly unusable areas, ranges from 9,000,000 to 10,000,000 acres. The former figure indicates practically 60 percent of the total area as actually or potentially available for some kind of agricultural or pastoral production. An interesting observation made by the survey party was that even on the summits of the high ranges the soil was thick and rich. Such an estimate would produce a table showing distribution of potentially cultivable areas, something as follows:

TABLE 8.—*Distribution of potentially cultivable areas by Provinces*

Province	Area		
	Cultivated	Potential	Total
	<i>Acres</i>	<i>Acres</i> ¹	<i>Acres</i>
San Jose	176,680	500,000	1,500,000
Cartago	218,160	300,000	1,000,000
Alajuela	133,595	1,800,000	2,750,000
Heredia	48,128	900,000	1,250,000
Guanacaste	193,550	2,200,000	3,250,000
Limon	218,907	1,200,000	2,500,000
Puntarenas	63,067	2,100,000	2,750,000
Total	1,052,087	9,000,000	15,000,000

¹ Estimated.

Stock raising.—The census of livestock published in the Statistical Annual for 1929 gives the figures shown in table 9.

The cattle industry has been considerably discouraged during the past few years by low prices caused in part by a considerable influx from Nicaragua, the unsettled conditions of that country inducing Nicaraguan cattle owners to sell cheaply across the border. At present about 35 percent of all the livestock is raised in the Province of Guanacaste (201,477 head) and nearly 20 percent in the adjoining Province of Alajuela. It is believed that if conditions warranted, the number of cattle could be increased sevenfold. The pasturage capacity of Guanacaste and Alajuela is strained not at all, that of the El General region in Puntarenas Province has scarcely been touched, and in addition there are great areas from the 6,000- to 10,000-foot (1,830- to 3,050-meter) level where cattle may browse contentedly on a shrub locally known as "cana de danta" and grass kept lush the year round by mists.³

TABLE 9.—*Census of livestock*

Kind	1922	1929
Cattle	476,184	398,737
Horses	95,385	84,563
Mules	5,792	7,944
Donkeys	139	233
Pigs	113,890	83,174
Goats	946	1,527
Sheep	1,026	766
Domestic fowls (all kinds)		1,064,908
Total	693,362	1,641,852

³ Among the best-looking cattle seen on the survey were those of Senor don Prospero Mena, of El Copey, whose herd grazes above Las Vueltas, over 10,000 feet (3,050 meters), on grass and cana. Among the largest cheese and dairy producers of the country are Senores Volio and Roberts, whose herds graze around the Volcano Irazu, 7,000 to 10,000 feet (2,135 meters). The gardens of these gentlemen grow practically every vegetable known to our temperate zone. The cheese produced by them is excellent and their herds are highly bred, Guernsey and Holstein.

² Plantas Usuales de Costa Rica, H. Pittier, p. 28, published by H. L. and J. B. McQueen, Inc., Washington, D.C., 1908.

Timber resources.—Table 10 shows exportation of wood products for the years indicated, by kilo and value.

Mahogany.—In 1925 the United States took 82 percent of the mahogany and nearly all the balsa. In 1929 no mahogany shipments were made to the United States. Half of the export went to Peru.

Senor don Fernando Castro, San Jose, owner of the daily newspaper La Tribuna and probably the largest timber owner in the country, says that while accessible mahogany is pretty well exhausted there is still some between the Rio Grande de Tarcoles and the Rio Pirris and another stand below the Rio Grande de Terraba and the Panama border. He estimates this as between 15,000 and 20,000 cubic yards, with another stand of about the same amount on the Nicaraguan border near the Rio Sapoá. With proper highway communication he believes the total amount available in the country would be in the neighborhood of 100,000 cubic yards.

TABLE 10.—*Exportation of wood products*

Kind	1925		1929	
	Kilos	Value \$10,040	Kilos	Value
Balsa.....	648,757		272,251	\$3,268
Cachimbo.....			101,112	2,228
Cedar.....	3,413,725	79,490	3,181,180	84,219
Cocobolo.....	659,187	19,776	194,740	5,852
Genizaro.....			33,236	928
Guayacan.....			6,028	193
Laurel.....	1,771,962	4,741		
Mahogany.....	1,910,519	56,704	61,702	1,777
Maria.....			8,880	283
Nispero.....			35,520	800
Pochote.....			145,178	3,299
Roble (oak).....			34,880	666
Brazil (dyewood).....	180,232	2,524	381,650	5,182
Mora.....	501,000	7,028	550,921	7,713
Total.....	9,086,382	180,303	5,007,278	116,408

He mentions a large stand of maria which is being used as a mahogany substitute, in the area between Rio Grande de Terraba and the Panama border, estimated at over 200,000,000 board feet. The Panama stand is probably an extension of this one. This area is said to contain an equal amount of crabwood, another mahogany substitute; while still another, vencola, is to be found in this general locality to an estimated quantity of 50,000,000 board feet. A cruise of a 5,500-acre tract of land belonging to Señor Fernando Castro, in the vicinity of Punta Guapinol, revealed 26,500 cubic yards of timber embracing 12 varieties. Still another mahogany substitute, of which considerable is found in this region, is espave which needs to be well seasoned before shipping.

Balsa.—Practically all balsa is shipped to the United States. There are large stands in the Golfo Dulce region and in Guanacaste, the former region yielding the better quality. Balsa should be allowed no rest in its growth. During the dry season the Guanacaste balsa stops growing and becomes fibrous. Balsa requires 6 years to develop.

Cedar.—Señor Castro claims to have about 50,000,000 board feet of Spanish cedar. The Costa Rican cedar is said to be not as clear as that of Nicaragua. No estimate of the total amount is available. It grows in most of the forest lands up to 6,000 feet (1,830 m.).

Cocobolo.—This is found somewhat north of Rio Terraba and on the Nicaraguan border. The existing supply is estimated to be not less than 50,000 tons.

Guayacan.—This is becoming scarce. The known supply is in the vicinity of Salinas Bay, estimated at 1,000 tons. This is called "lignum vitae" in commerce, but it is not true lignum vitae, although it is an excellent substitute.

Oak.—No estimate is available as to the amount of oak stumpage, but the survey party was amazed at the amount of this timber growing between 3,000 and 8,000 feet (915 and 2,440 m.) elevation. In the highlands the white oak predominates and lower are to be found black oak and savannah oak. With a highway running at about the 3,000-foot (915-m.) level, a large portion of this white oak area in the south could be developed. It has been suggested that because of the many swift and sizable streams the splashdam method of getting logs down from the upper areas might be used to advantage.

In the Golfo Dulce region is to be found considerable tecoma, a wood closely allied to English greenheart, and in the gulf basin is standing not less than 50,000,000 cubic feet of nazarena, a beautiful light purple hardwood normally quoted at 75 cents a cubic foot. There is also considerable fustic (dyewood) in the Golfo Dulce region.

Inasmuch as the timber resources still available in large stands exist in the previously undeveloped areas, it is to be noted that a large majority of those listed is close to the line of the proposed route or actually on it. The highway would permit of ready marketing of much of these valuable stands, either by direct haul to present railroads or water shipping points, or indirectly by furnishing access to the timbered areas, many of which are now quite inaccessible.

MINING

William R. W. R. Scott, associate of the Institute of Mining and Metallurgy (London), a resident of San Jose, whose investigations have in general been more extensive, perhaps, than those of any mining expert in Costa Rica, divides the country into eight mining districts.

According to Mr. Scott, district 1 (Guanacaste) contains strong outcrops of gold sulphide veins on the west side of the cordillera and free-milling gold on the east side.

A number of iron and copper deposits have been acquired running from the south of Santa Cruz about 20 miles (32 km.) up to Culebra Bay. Ore from

one of these holdings assayed 17 percent copper, 14 ounces of silver, and \$4 gold per ton.

On the Playa Real are large deposits of manganese which were worked during the World War when H. T. Purdy, an American business man in San Jose, shipped 60,000 tons of this ore to the States, much of it running as high as 85 percent manganese.

Anthracite coal is reported on the north side of Helena Bay; lignite is also reported near there, as well as another deposit between the Rios Orosi and Cucaracha, a few miles from Lake Nicaragua. Heavy oil seepages, with some asphalt, have been encountered on the coast.

A bed of good quality sulphur runs along the foothills of the Volcanoes Orosi, Gongora, Rincon de la Vieja, and Miravalles for a distance of about 30 miles (50 km.). Asbestos is said to exist in this province, "but of that I have no proof", adds Mr. Scott.

In district 2, comprising the Peninsula of Nicoya lying to the south of Guanacaste, only oil shales are reported.

Of district 3 (Gatuso, east of Guanacaste), Mr. Scott says, "some good gold has been met with." The Libano mine is in the southwest of this district.

District 4 (Abangarez) includes the group of gold mines, Tres Amigos, Tres Hermanos, Guacimal, and others, and merits further prospecting.

District 5 (Aguacate and Central) contains the Aguacate group of gold mines which could be developed into a large proposition. There are many gold veins to the north of this group. Among other more or less well-known workings are San Gerardo, El Penon, La Union, Trinidad, Montezuma, Santa Clara, El Corinto, and others, all gold. Near Volcano Poas is a well-known sulphur deposit and to the northwest, "I have come across some graphite."

In district 6 (Cartago) there are old gold workings of the Spaniards. Mr. Scott believes the proposed inter-American highway would open up other gold prospects in this area.

District 7 (Talamanca, Province of Limon) has good gold dredging ground near the Panama border.

District 8 (Chiriqui), which is adjacent to Panama, contains many indications of veins and alluvial gold. There is a holding in this area of 10,000 acres of auriferous sands.

Mr. Scott declares that the failure of mining in Costa Rica up to date "has arisen entirely from inadequate management and consistent failure to keep development ahead of the mill, combined with sketchy prospecting and development work."

Mr. Harold H. Juchen, graduate of the Denver School of Mines, and for many years engaged in mining in Costa Rica, in speaking of gold locations supplements Mr. Scott's remarks somewhat as follows:

So far as I have been able to observe, all the workable gold deposits in Costa Rica (veins and lodes) lie upon or very near

to a straight line drawn on the map between the Abangarez gold fields and the Minas del Aguacate in the Aguacate Mountains west of San Jose, and upon extensions, very limited in extent, of this line. I have examined thousands of samples from all parts of the Republic and cannot remember even one of any value that did not come from the section mentioned. Upon this line, starting at the eastern extreme, are the Compania, the Union, Sacra Familia, Britania, Tamayo, San Gerardo, Penon, Orlich, Buena Suerte, Corinto, Hervideros, Camarones, the Titania group, Santa Clara, Montezuma, Trinidad, Infanta, Guacimal, the Abangarez group, and Libano. All of these have been worked at one time or another; all have produced gold in some quantity. There are three potential placer areas in Costa Rica so far as my knowledge goes: One on the peninsula of Golfo Dulce, another at the mouth of the Rio Barranca, and the third is on the Rio Coen in Talamanca.

According to Mr. Juchen, near Esparta, near San Ramon, and near Puriscal there are deposits of free copper, unprospected. There is a very large galena (lead) vein south of Aserri, which carries some gold. Samples of galena have been found in the San Carlos Valley. Lead and zinc are found near Uruca, near Villa Colon, near Aserri, near Cartago, near Laguna, and at Guacimal. There is a deposit of sulphur in the San Carlos Valley near Alfaro Ruiz and a deposit of manganese on the extreme southern point of the Nicoya Peninsula.

WATER POWER

Information concerning available water power in Costa Rica is very scanty. The only data possessed by the leading company covered the Meseta Central, the area which at present represents the principal market. There is a statement in the office of this company, apparently taken from the World Atlas of Commercial Geology, prepared by the United States Geological Survey in 1920, which estimates total power at 1,000,000 horsepower, and of this amount 43,821 was at work in 1931. There are 14 public electric-power units in the country with capacities varying from 225 to 3,750 kilovolt-amperes and there are a large number of small plants for private use. The Rio Blanco, flowing from Miravalles through the Guanacaste plain, has several waterfalls and its potential power is said to be sufficient to meet any development in that Province that the future may require. The Rios Savegre, Providencia, Naranjo, General, and many more rivers in the south have large potentialities and the same is true of the Reventazon and other rivers in the eastern part of the country.

MANUFACTURING

The Statistical Annual of Costa Rica for 1929 lists 6,532 so-called "industries" and their locations by Provinces. On the face of it, this list is rather formidable, indicating as it does 1 factory for each 79 of population. It is to be remembered, however, that the great majority of these factories is of handicraft dimension, some of them very crude, yet their number gives

evidence of a relatively industrious people. Manufacturing is for local consumption only.

Examples of industries developed to large commercial proportions are coffee and cacao processing, 2 or 3 sugar mills, a couple of dairies, a fine fruit conserve plant, a cigarette factory, a sawmill or two, a shoe factory, and a brewery not included in the official list. At the time of this writing (1933) it is doubtful if the number of these industries totaled 60 percent of the number normally operating.

TRANSPORTATION AND COMMUNICATION

Ocean transport.—In 1931 there were 510 vessels with a registry of 1,283,000 tons cleared through Costa Rican ports, while in the same year 514 vessels with a registry of 1,291,000 tons entered.

According to the Costa Rican bureau of statistics, the tonnage of 1930 importations totaled 90,350 metric tons compared with 149,564 metric tons the previous year. This import tonnage was distributed through the regular ports of entry as shown in table 11.

TABLE 11.—*Import tonnage by ports of entry*

Port	Percent of total tonnage	Value
Limon.....	54.93	\$6,112,000
Puntarenas.....	43.68	3,211,000
Sixaola.....	.87	68,738
Colorado.....		430
Total.....		9,392,168

In addition, 0.34 percent, valued at \$1,089,419, came in by parcel post and 0.18 percent, valued at \$138,202, was admitted as baggage. The remainder, about \$227,000, appears to have consisted of cattle imported from Nicaragua by way of the border towns of Pena Blanca, Conventillos, La Cruz, and Los Andes, and over the San Carlos wharf—in all, 14,143 head.

It has been noted that the bulk of import tonnage enters the ports of Limon and Puntarenas. Apparently in 1929 it aggregated about 86,000 metric tons for the former and 61,500 for the latter port, out of a total that year of 149,500 tons.

A glance at the coastwise freight movement out of Port Limon for 1929 shows that 322 tons of freight, valued at nearly \$74,000, were delivered to the 10 ports of call along the Atlantic coast, together with 1,380 passengers; while 1,921 tons of freight and 860 passengers were transported from those ports to Limon. The record for Puntarenas shows 1,968 tons of freight and nearly 20,000 passengers transported to small ports along the Pacific seaboard, some 116 in number, and 13,021 tons of freight and nearly 21,000 passengers were brought to Puntarenas from those ports. To this last item should be added 27,000 head of cattle.

It is to be noted that while general export and import business is heavier on the Atlantic side, due largely to the presence of the banana industry on that coast, local trade is much heavier on the Pacific side. This indicates the soundness of locating the highway along the Pacific slope where the population centers are commoner and the back country more developed. This same condition exactly existed in Panama and with construction of the inter-American highway in Costa Rica the same economic improvement along the entire Pacific coast of Costa Rica may be expected, as has actually occurred in Panama.

This outbound coastwise trade consisted of iron and steel manufactures, gasoline, salt, cement, foodstuffs, beverages, etc., 70 percent of which, or about 1,600 tons, it is estimated, was of foreign origin. It would seem, therefore, that but a trifle more than 1 percent of the import tonnage of Costa Rica is at present distributed to the outlying seaboard by coastwise vessels, leaving about 148,000 tons to be distributed by rail, et cetera, to the Meseta Central where over 75 percent of the population is gathered, and by bull cart, pack, et cetera, to towns as far south as Santa Maria de Dota and San Marcos and north to the San Carlos district.

High cost of present transport methods.—Heavy charges are added to merchandise costs in Costa Rica at present, due to inadequate means of transport.

Some idea of the cost of getting merchandise from the seaboard to the upper and lower interior towns may be derived from the following observations made while traversing Costa Rica.

Bagaces is served from the port of Bebidero, a distance of about 14 miles (23 km). The cost of carting to Bagaces is from 20 to 35 cents a quintal (100 pounds) depending on the weather and is higher, of course, in the rainy season. Roads require about a month to dry out after the rains have ceased.

Liberia is served from Ballena, distant 20 miles (32 km). Carting runs from 25 to 75 cents a quintal. La Cruz is served from the new port of Soley, about 3 miles (5 km) down a steep hill, and from Ballena, which is about 50 miles (80 km) distant. The freight rate from Soley is 40 to 50 cents a quintal; from Ballena, \$1.25 to \$1.50 a quintal.

The towns in the vicinity of Santa Maria de Dota, including San Marcos, San Cristobal, Frailes, Candelaria, and east to El Copey, are supplied about 70 percent from San Jose and 30 percent from Cartago over a bull-cart road in fair condition in dry weather. Freight runs from 80 cents to \$1 a quintal and requires 2 to 3 days' transit, depending on the weather.

San Isidro del General, Palmires, and other points in the valley of the Rio General receive most of their supplies via the ports of Uvita and Dominical, both distant 18 to 20 miles (29 to 32 km). Cart rates

average \$1.65 to \$2 to El Volcan, \$2.50 to Buenos Aires, and the haul requires 2 days.

Some cargo and mail are packed over the Cerro del Muerte (Death Mountain), 11,500 feet (3,355 meters), from San Jose and Cartago to El General Valley at high cost, tremendous effort, and considerable loss in transit. A yoke of oxen will haul 800 pounds in wet, and 1,000 to 1,200 pounds in dry, weather in the flat sections and 400 to 900 pounds in the mountain sections. The loss by spoilage and breakage in transit has been estimated as high as 15 to 20 percent in the rainy season. The effect on retail prices of these delivery costs superimposed on freight rates, by no means low, to the chief ports of entry, as well as other handling charges, may be imagined, and the consequent handicap to effective merchandising is apparent.

For example, the following prices of American food-stuffs were noted in Buenos Aires where the survey party tarried a couple of days: Crackers, \$3 a 2-pound box; can of pears, 75 cents; oatmeal, 50 cents a pound; can of evaporated milk, 45 cents; can of grapes, 75 cents; can of salmon, 40 cents; onions, 50 cents a pound. Native produce, not locally produced, was also high.

The effect of these transportation obstacles on local marketing is no less distressing. For example, at the time field work was in progress (December 1931), corn grown in Guanacaste was selling at \$2.50 per 800 pounds; delivered at San Jose it sold for \$15. Rice selling in Guanacaste for \$1.75 a quintal brought \$8 in San Jose. In this connection, a recent issue of one of the leading San Jose papers commented on the fact that, due to lack of adequate highway transportation, it is cheaper to import rice from the Orient and distribute it from San Jose and Puntarenas than to raise it in Guanacaste or on the Golfo Dulce and distribute it from those territories throughout the country, notwithstanding the fact that those two sections are admirably adapted to rice production.

Under the crudest imaginable conditions, an excellent grade of tobacco is produced in El General Valley. Packed in a 60-pound roll, this tobacco is frequently carried by porters over the Cerro del Muerte to San Jose and sold at from 10 to 20 cents a pound.

George Stewart Wilson, formerly of Texas, is a prominent cattle raiser near Bebidero. He markets his cattle in Alajuela, driving 50 head fortnightly to that point, which is distant 80 miles (130 km). The time required is 7 days and sales average \$25 a head. He loses over 10 percent weight en route to market. The cattle could be transported in 4 hours over a motor highway, with no loss in weight.

In some instances it costs more to get a load of coffee berries from the finca (plantation) to the beneficio (coffee central) than it does to process the berries and ship the green coffee to Europe or to the United States.

There are literally millions of feet of good white oak now rotting on cleared land. Some of the fallen timber

is still partly sound although it has lain for 25 years. There are many more millions of feet now standing, but they are practically valueless at present for lack of means to get them to seaboard. There are other valuable woods in this same region and, in spite of difficulties of transport, about 5,000 metric tons of timber were exported in 1929, valued at \$116,500, of which 60 percent by volume was Spanish cedar.

With the extension of the present system of highways on the central plateau, still inadequate though it may be, the price of domestically produced sugar has been greatly stabilized in that locality, and consumers are no longer harassed by violent fluctuations in price.

Highways.—In 1931 Costa Rica had 158 miles (254 km) of concrete, macadam, and rock-surfaced highways and approximately 2,000 miles (3,220 km) of earth roads which, being passable only during the dry season, may properly be classed as trails. In San Jose, the capital, there are about 16 miles (26 km) of concrete-paved streets, and the streets of the Port of Limon have been paved also, but all other cities and towns still have the old cobblestone streets.

Railways.—A total of 430 miles (690 km) of railways has been constructed. The railroads in Costa Rica occupy the central portion of the Republic, crossing from coast to coast, from Limon to Puntarenas. There is no rail communication either to the north or south. The first 30 miles (50 km) from Limon toward San Jose pass through banana lands; the balance is cattle, coffee, general agriculture, and fruit country interspersed with uncultivated mountainous areas.

Inland waterways.—The San Juan is the most important river affecting the Republic of Costa Rica. It flows along the northern boundary, connecting with Lake Nicaragua in the Republic of Nicaragua, and is navigable for small vessels. There is launch service between Puntarenas and other small ports on the Gulf of Nicoya and rivers debouching thereinto as far up as Bedidero and Ballena. On a number of rivers flowing to the Pacific or Atlantic Oceans, large dugouts are availed of for freighting. The Rio Tarire is said to be navigable for small craft in its lower reaches.

Airways.—The first regular commercial air services in Costa Rica were inaugurated in January 1933 by the Empresa Nacional de Transportes Aereos, a company formed by a group of American citizens. According to a 5-year contract signed by the Government, this company will operate an air passenger, mail, and express service through Costa Rica. San Jose is used as the base of operations, from which point approximately 12 towns are served at least once a week.

Pan American Airways' service from Miami through Central and South America has an intermediate stop at San Jose.

In the vicinity of San Jose there are two airports, La Sabana and Santa Ana. The latter is the port of

call of Pan American Airways which formerly used La Sabana. A first-class road connects Santa Ana with San Jose. This airport has been improved considerably in the past year or two. At La Sabana, owned by the municipality of San Jose, the field has a hard surface which should be usable in any kind of weather. Other landing fields have been developed by the newly formed commercial company. No equipment for night flying exists at any of the airports.

Automobile statistics.—There was registered in Costa Rica on January 1, 1933, a total of 1,719 motor vehicles, of which 1,316 were passenger cars; 90, busses; and 313, trucks. These automobiles are in great majority owned and driven in the capital and nearby towns where there are improved streets and highways.

HIGHWAY ECONOMICS

Existing bus service.—According to the American consul at San Jose, there were 90 busses registered in Costa Rica as of December 31, 1932. Eighty run regularly during the dry season and 60 to 65 operate in the wet season. There is a scheduled line: One bus every hour, from San Jose to Cartago; and another, one bus every 2 hours, from San Jose to Alajuela, day service only. There is a line running from Alajuela to Naranjo, two to four times daily. There are busses to the various suburbs—San Isidro, Tres Rios, etc.—every half hour or so. Occasional busses run to other towns. The number of passengers carried annually is estimated to be anywhere from 1,000,000 to 1,500,000.

Future highway development.—The following are suggested as practicable locations for future road construction, which could connect with the proposed inter-American highway and over which bus and truck operations could eventually be developed.

1. From Paso Real down the Rio Diquis to the Pacific Ocean at El Palmar which is on tidewater.
2. From El General Valley across the coastal range to Puerto Dominical.
3. Down the Rio Naranjo to the Pacific coast.
4. From San Marcos up the Rio Parrita to El Copey.
5. Down the Rio Parrita to the Pacific coast.
6. From El Alto via Cartago and Paraiso to Turrialba and the Atlantic coast. Along this possible route there is already some construction.
7. Several laterals from San Jose to surrounding territory.
8. From San Jose across the central cordillera toward Guapiles to the Atlantic lowlands, on the line of an old railroad survey.
9. From Naranjo, a possible line through Zarcero to the Comandancia of San Carlos and the lowlands of the Rio San Juan.
10. From Las Canas to the Gulf of Nicoya.
11. From Las Canas across the Continental Divide near Lake Arenal to the lowlands of the Rio San Juan.
12. From Liberia into the Peninsula of Nicoya.

Tourist traffic.—The majority of tourists visiting Costa Rica enter the capital from the Atlantic coast, through Puerto Limon and over the Costa Rica Railway, traveling on United Fruit Co. steamers. During recent years San Jose has been popular as a health resort for Americans working in the Canal Zone and for Panamanians. The elevation and cool climate have an invigorating effect on those whose duties have confined them to tropical sea levels. A very few tourists visit the capital through Puntarenas, the principal Pacific coast port, via the Pacific Railway. This route is growing in popularity with commercial travelers. Due to lack of highways, tourists as a rule confine themselves to visiting San Jose where hotel accommodations are very good.

Government bureau of highways.—Highway construction is administered by the Department of Public Works, under the immediate supervision of the Director General de Caminos. Usually each job is advertised for bids. In 1930 a loan of \$4,000,000 was sought, but not obtained, to pave streets in San Jose.

The administration has constructed the existing roads on the Meseta Central and has made extensive reconnaissances and done some location work toward Esparta and into the San Juan Valley.

National funds for road building are derived from taxes on land, liquor, sugar, and gasoline. The provinces and municipalities tax vehicles, merchandise, and properties bordering on the roads. A road-building plan calling for an expenditure of \$3,250,000 was begun in 1929 and two American firms were awarded contracts for 193 miles (310 km), to cost \$2,750,000. Thirty percent of the program was accomplished, but the contracts were canceled owing to lack of funds. Budget appropriations for road building are not available for the current year (1933) or the previous year, but it is known that there have been little or no funds.

PUBLIC LANDS

The best estimate available of the amount of public lands remaining in the hands of the Costa Rican Government is approximately 5,000,000 acres, or about one-third of the total area of the Republic. Senor Jose Pablo Rodriguez, of San Jose, a surveyor and extensive landowner, who has made a fairly careful study of the locations of these public lands, divides them among three areas as follows:

1. The area stretching toward the Panama boundary from a northeast-southwest line passing through a point about 12 miles (20 km) below Cartago, and containing approximately 2,000,000 acres of public lands of which, roughly, 1,500,000 acres would be tributary to the proposed inter-American highway; that is, either adjoining the road or accessible thereto by lateral roads or streams.
2. The area embraced by the high line of the central cordillera, the Rio San Juan, and the Caribbean Sea,

estimated at over 2,000,000 acres, none tributary to the highway if the latter should pass through Guanacaste.

3. The area including the cordillera Guanacaste, the Guanacaste Plains, and the Nicoya Peninsula, estimated at 1,800,000 acres. Of this about 500,000 acres in the Guanacaste section would be tributary to the highway.

Senor Rodriguez places an average value on all public lands of \$5 a hectare, or \$2 an acre, a figure which is endorsed by a number of those qualified to know. Accessibility to highways or navigable streams has a marvelous effect in appreciating the value of Costa Rican lands. For example, some years ago a former Costa Rican Minister of Foreign Relations who had tracts in El General region states that he sold a piece of his uncleared land far from any traffic line for \$5 a hectare. The purchaser constructed a bull-cart road from this land to join with another cart road leading to a small Pacific port. Immediately the value of adjacent lands leaped to \$20 and \$25 a hectare, or 300 to 400 percent.

Any estimate as to the probable value of those public lands tributary to the inter-American highway, once it is constructed, is largely speculative, but that they would easily more than treble in value seems certain, so that the total value of the 2,000,000 tributary acres of public lands should be somewhere between \$12,000,000 and \$15,000,000, which is believed to be a very conservative estimate. This amount, nevertheless, if realized through land sales is considerably greater than the probable cost of Costa Rica's share of the highway. And once the road is built there would be little difficulty in disposing of these lands under a more liberal policy of Government land sales than at present exists.

About a score of years ago the Government of Costa Rica, with a view to assisting financially a number of the municipalities, issued land scrip locally known as "gracias", allotments of which were made to these municipalities, the money from the sale of the lands to be covered into their respective municipal treasuries. Each coupon was convertible into 1 hectare of public land on the Atlantic and 2 hectares on the Pacific side. A large fraction of these coupons came into the hands of an American fruit company. According to the law under which these "gracias" were issued, public lands located on navigable streams were exempt from scrip operation. The aforesaid company has attempted to exercise its "gracias" on land in the vicinity of the Golfo Dulce and elsewhere on streams said to be navigable for very small craft and the government has contested these attempts on the ground that these lands come under the exemption. The matter is still in litigation.

A native head of family is permitted to homestead 50 hectares of land which he cannot alienate, but once

the land passes to his children by his death they may transfer title. Since the inter-American highway became a live topic of discussion in Costa Rica there is reported to be considerable activity in exercising homestead rights, particularly in those sections through which it is surmised the highway will pass. Bargaining is said to be going on with present holders of titles and the lowly natives are being urged by speculators to exercise homestead rights.

The present tax on land is one-quarter of 1 percent on cultivated and one-half of 1 percent on uncultivated holdings. These rates are on the fully assessed value of the land. This tax yielded \$200,000 of revenue in 1930 and the cost of collection was about \$30,000. The *Tributacion Directa* (Direct Tax Bureau) declares that this tax should yield about \$250,000.⁴ Collection enforcement is being tightened gradually. The revenue from this source was but \$90,000 four years ago. No data were available indicating what portion of these receipts came from cultivated, and what from uncultivated lands. The receipts are lumped. Holdings under \$750 in value are exempt from the tax.

About 1 in every 5 of the inhabitants owns his home and many of these holdings—perhaps 75 percent of the plots of an average value of \$150 a hectare or more—now come within the \$750 land-tax exemption. All would be benefited in greater or less degree by construction of the inter-American highway and there would seem to be no good reason why any land holding should be exempt from tax. Should the government dispose of its remaining public lands by way of homestead or other method of native acquisition and ordain that the land tax therefrom, or a portion thereof, should be devoted to road maintenance, it might justifiably expect several hundreds of thousands of dollars of receipts annually from this source, either in currency or its labor equivalent. This would be enough to keep the highway in a first-class condition of repair.

The subject of colonization in Costa Rica, now that there is a vision of a grand-trunk highway, is being widely discussed. A thrifty colony properly safeguarded by law scrupulously observed on both sides could endow this territory with an agricultural productivity equal to any observable in Latin America.

Another rich territory is the Talamanca region, concerning which Ricardo Fernandez Guardia says:⁵

Talamanca is the name by which, since the first years of the Seventeenth Century, the Costa Rican territory situated in the southeastern extremity of the country has been known. This territory was then bounded on the north by the ancient district of *Tierra Adentro*; on the east by the Caribbean Sea and the

⁴ Applying these tax rates to the first 3 items listed in the figures on gross wealth, table 3, it is interesting to note that we would have the following: From cultivated lands at 0.25 percent, \$121,250; from grazing lands at 0.25 percent, \$30,000; from private uncultivated lands at 0.5 percent, \$100,000; a total of \$251,250.

⁵ *History of the Discovery and Conquest of Costa Rica*, by Ricardo Fernandez Guardia, translated by Harry Weston Van Dyke, Thomas Y. Crowell Co., publishers, New York, 1913.

Province of Veragua; on the west by the Great Cordillera; and on the south by the same Province of Veragua. * * * The Talamanca district of today, reduced as it is to its present narrow limits, and despoiled of the splendid Almirante Bay and the no less beautiful Chiriqui Lagoon, is nevertheless as picturesque a region and possessed of greater natural riches than any in Costa Rica. * * * From the circumstance that almost the entire population of Costa Rica is concentrated upon a strip running through the middle of its territory from one sea to the other, it results that the districts situated to the north and south of the Republic, and by which it borders on Nicaragua and Panama, respectively, remain almost wholly deserted with the exception of Guanacaste; yet it is unquestionably true that if the Spaniards had been able to establish themselves in Talamanca, that region today would be one of the most thickly populated, extensive and prosperous in the Republic. * * * The territory of Talamanca, like the rest of Costa Rica, is mountainous in the extreme, covered with an exuberant tropical vegetation, and irrigated by an infinite number of rivers, though some of them are obstructed by very difficult rapids. The Tarire is navigable in its lower course; that is, in that part of the stream known as the Sixaola.

FOREIGN TRADE

Tables 12 and 14 show the exports and imports of principal commodities for the years 1920-31. Table 13 gives the destination of exports by countries for 1929 and table 15, the origin by countries of imports for the same year.

TABLE 12.—Exports of principal commodities, 1920-31

Year	Product					
	Bananas	Cacao	Coffee	Sugar	Gold	Total ¹
1920	\$2,591,000	\$301,000	\$4,664,000	\$850,000	\$623,000	\$12,462,000
1921	2,816,000	255,000	1,861,000	233,000	241,000	11,887,000
1922	2,473,000	555,000	3,301,000	100,000	227,000	14,224,000
1923	2,479,000	520,000	2,245,000	251,000	260,000	17,833,000
1924	6,065,000	726,000	8,427,000	53,000	640,000	16,565,000
1925	6,262,000	620,000	8,403,000	18,000	593,000	16,416,000
1926	6,421,000	824,000	10,624,000	8,000	506,000	18,962,000
1927	5,092,000	661,000	10,611,000	-----	359,000	18,058,000
1928	5,493,000	1,025,000	12,380,000	-----	228,000	19,636,000
1929	4,584,000	895,000	12,226,000	-----	26,000	18,198,000
1930	4,376,000	966,000	10,419,000	-----	-----	16,300,000
1931	3,175,000	669,000	10,116,000	-----	32,000	14,279,000

¹ This column includes many miscellaneous exports not classed as principal items

TABLE 13.—Destination by country of exports in 1929

Country	Product			
	Bananas	Cacao	Coffee	Gold
United States	¹ \$2,622,000	\$431,000	² \$801,000	\$26,000
Panama	-----	195,000	-----	-----
Colombia	-----	96,000	-----	-----
France	-----	26,000	-----	-----
Germany	-----	41,000	² 1,461,000	-----
Netherlands	-----	-----	² 233,000	-----
United Kingdom	¹ 1,721,000	14,000	² 7,588,000	-----

¹ 1930.

² 1931.

TABLE 14.—Imports of principal commodities, 1920-31

Year	Product					
	Lard	Wheat flour	Cotton fabrics	Silk fabrics	Iron and steel	Tools and machinery
1920 ¹	-----	-----	-----	-----	-----	-----
1921	\$95,000	\$410,000	\$399,000	\$60,000	\$300,000	\$256,000
1922	114,000	365,000	446,000	112,000	230,000	164,000
1923	98,000	353,000	750,000	94,000	341,000	254,000
1924	213,000	758,000	2,086,000	285,000	704,000	660,000
1925	414,000	1,013,000	2,024,000	362,000	1,024,000	768,000
1926	424,000	970,000	1,414,000	159,000	1,040,000	877,000
1927	411,000	956,000	1,671,000	218,000	1,115,000	954,000
1928	462,000	975,000	1,423,000	191,000	1,250,000	1,355,000
1929	514,000	902,000	1,428,000	308,000	1,751,000	2,190,000
1930 ¹	-----	-----	-----	-----	-----	-----
1931 ¹	-----	-----	-----	-----	-----	-----

¹ Details not available.

² This column includes many miscellaneous imports not classed as principal items.

TABLE 15.—Origin by countries of imports in 1929

Country	Product					
	Lard	Wheat flour	Cotton fabrics	Silk fabrics	Iron and steel	Tools and machinery
United States	\$516,000	\$849,000	\$881,000	\$204,000	\$732,000	\$1,021,000
Mexico	-----	-----	-----	-----	-----	8,000
Panama	1,000	5,000	2,000	1,000	-----	3,000
Belgium	-----	-----	29,000	-----	162,000	9,000
France	-----	-----	12,000	33,000	5,000	11,000
Germany	-----	-----	35,000	8,000	651,000	1,010,000
Italy	-----	-----	65,000	-----	1,000	17,000
Netherlands	-----	-----	5,000	4,000	18,000	5,000
Spain	-----	-----	5,000	-----	1,000	-----
United Kingdom	7,000	48,000	332,000	25,000	144,000	90,000
Switzerland	-----	-----	19,000	19,000	-----	-----
Sweden	-----	-----	-----	-----	3,000	2,000

It will be noted that over the period 1920-31 exports have aggregated \$189,820,000 and imports \$163,233,000, the period yielding a favorable trade balance in the exchange of goods of \$26,587,000, or an annual average of about \$2,216,000. In only 2 years was the balance against the country: In 1920 (\$9,914,000), when better than normal conditions stimulated foreign purchases; and in 1929 (\$1,966,000), due in part to a drop in coffee prices and in part to the purchase abroad of considerable road machinery and material.

Expressed in index numbers and using 1920-24 as the base period of 100, exports increased to 144 in 1928, 134 in 1929, and 105 in 1931; imports increased to 163 in 1929 but declined to 70 in 1931, while population increased to 119.6. Per capita exports increased from \$30 to \$36.11 in 1929 but declined to \$27 in 1931; imports decreased from \$42.08 to \$40.07 in 1929, and then declined to \$17 in 1931; total foreign commerce shifted from \$71.67 to \$75 in 1929 and then declined to \$44. In 1925 the share of the United States in the import trade of Costa Rica was 54 percent, or \$7,484,000; in 1929 it was 48 percent, or \$9,682,000; and in

1931 it was 52 percent, or \$4,501,264. The United States took nearly 28 percent of Costa Rica's exports in 1929, compared with about 31 percent the previous year. In 1931 the participation was 25 percent. The favorable balance of trade for 1930 totaled nearly \$5,500,000. In 1931 the favorable balance was \$5,598,000. The effect of the world depression in 1931 is reflected in the fact that the foreign trade of Costa Rica that year fell to \$44 per capita.

FINANCES

Receipts and expenditures.—The Costa Rica budget has fluctuated considerably over a period of years. In 1913, with receipts of 9,613,000 colones and expenditures of 10,814,000 colones, the Government encountered a deficit which increased in ensuing years until, in 1919, it had mounted to 9,342,000 colones. Then the trend was upward and in 1922 the books closed for the year with a surplus of 1,639,000 colones. The surplus continued until 1927, when it amounted to 7,265,000 colones; then the budget lost ground rapidly until in 1930 there were 5,045,000 colones (\$1,261,250) standing on the red side of the Costa Rican ledger, with receipts of 27,469,000 colones and expenditures of 32,514,000 colones. The detail of the 1932 budget follows in tables 16 and 17.

These figures show a decrease in receipts of over 4,000,000 colones and in expenditures of nearly 7,000,000 colones, compared with 1930. It is estimated that receipts for the fiscal year 1933 will be about the same as those for the previous year, while expenditures will be 1,300,000 colones less.

TABLE 16.—Value of Government receipts in 1932

Source:	Colones ¹
Customs.....	10, 440, 000
Liquors.....	2, 771, 000
Pacific railways.....	1, 742, 000
Export taxes.....	2, 281, 000
Direct taxes.....	1, 140, 000
Conversion taxes.....	368, 000
Banana exports.....	371, 000
All other.....	3, 983, 000
Total.....	23, 096, 000

TABLE 17.—Value of Government expenditures in 1932

Expended for—	Colones
Legislature.....	454, 000
Interior and police.....	2, 255, 000
Public health.....	854, 000
Public works.....	3, 819, 000
Foreign relations.....	183, 000

¹ Par colon is equal to 25 cents.

TABLE 17.—Value of Government expenditures in 1932—Cont.

Expended for—Continued.	Colones
Justice.....	67, 000
Religion.....	56, 000
Education.....	3, 906, 000
Public safety.....	2, 594, 000
Finance.....	2, 928, 000
Judiciary.....	865, 000
Public debt.....	7, 044, 000
Total.....	25, 025, 000

Public debt.—According to the American consul at San Jose, the external debt of Costa Rica, as of December 31, 1932, was 83,794,000 colones, consisting of the following items:

Gold refunding bonds of 1911, 5 percent (British pounds).....	£1, 419, 620
French loan of 1911, gold francs.....	Fr. or 5, 811, 000
United States loan of 1926.....	\$7, 198, 000
Pacific Ry. bonds.....	\$1, 589, 000
English construction company.....	£68, 114
Conversion bonds of 1932, 5 percent (for United States loan of 1926).....	\$1, 597, 956
National City Bank of New York, loan.....	\$713, 067

The internal debt consisted of 22,405,331 colones, the amount of the floating debt; Limon sanitation bonds, amounting to \$334,000; and other domestic bonds to the amount of 7,216,831 colones. The rate of conversion is not given, but at par of exchange this would give an external debt of \$20,948,500, an internal funded debt of \$2,138,200, and a floating debt of \$5,601,000.

It is stated that the government is co-responsible for the debts of the Credito Hipotecario (Mortgage Bank) of about \$6,000,000 for which the Credito holds mortgages on properties in the country, the value of many of which would be considerably enhanced by the construction of the inter-American highway.

American investments.—According to the figures of the Bureau of Foreign and Domestic Commerce, United States Department of Commerce, American long-term investments in Costa Rica at the end of 1930 amounted to approximately \$32,661,000, as follows:

Direct investments:	
Transportation and communication.....	\$12, 205, 000
Miscellaneous (including fruit companies).....	10, 209, 000
Total direct investments.....	22, 414, 000
Portfolio investments:	
National government securities.....	8, 447, 000
Government guaranteed cooperation.....	1, 800, 000
Total portfolio investments.....	10, 247, 000
Total American investments.....	32, 661, 000

The above figures were obtained from the various American companies and banking organizations having interest in Costa Rica. An earlier consular report, dated October 14, 1929, on the other hand, places a somewhat lower value on American investments in Costa Rica as shown in table 18.

TABLE 18.—*American investments as of 1929*

Type of investment:	Value
Public utilities (light and power plants, communication, and transportation) ¹ -----	\$6,700,000
Mining-----	400,000
Banking-----	250,000
Real estate ¹ -----	2,700,000
Cattle and cattle farms-----	1,700,000
Coffee, banana, and cacao farms ¹ -----	3,050,000
Lumber and lumbering-----	450,000
Trading-----	650,000
Loans-----	9,800,000
Total-----	25,700,000

In addition to American investments, considerable other foreign capital has found its way to Costa Rica. A consular report, dated September 12, 1930, estimates that about \$29,000,000 of British capital is invested there, mostly in governmental and railway securities; German investments totaled about \$5,000,000; and French, Spanish, and Italian investments totaled about \$3,000,000 each. It should be emphasized that these estimates are mere guesses and that no accurate statistics are available.

Gasoline tax.—In June 1931 the Government of Costa Rica established a monopoly on the importation and sale of gasoline. On August 18, 1933, it established a consumer's tax of 2½ cents a gallon on gasoline. It is too early to state what this tax yields.

TECHNICAL SECTION

The proposed route.—The southeastern terminus of the section of the inter-American highway in Costa Rica is a point on the Panama-Costa Rica boundary line approximately 6.25 miles (10 kilometers) northeast of Canas Gordas. The boundary line is taken as the ridge that runs N. 10° E. and lies between the waters of the Rio Chiriqui Viejo in Panama and the Rio Brus in Costa Rica.

The northwestern terminus is a point on the Costa Rica-Nicaragua line near Penas Blancas on the left bank of the Rio Sapoa.

Junctions are made by the proposed highway as follows: At Terraba with trails leading into the adjacent country; at San Marcos with earth roads leading to San Jose and Santa Maria de Dota and also with trails leading toward the Pacific Ocean; at El Jardin with trails leading into contiguous territory; at El Alto with an improved road from Cartago to San Jose and Naranjo; at San Jose with roads radiating short dis-

tances into the surrounding country; with both the Atlantic and Pacific Railroads and the Pan American Airways; at Alajuela with the above-mentioned railroads; at Tacares with a road improved as far as Naranjo and extending as an earth road from there into the valleys of the Rios San Carlos and San Juan; at Bagaces, Liberia, Santa Rosa, and Santa Cruz with trails leading toward the Gulf of Nicoya and to interior sections of the Republic.

There were four possible routes considered and investigated between the Panama boundary and San Jose, the capital of Costa Rica. All enter Costa Rica at the same point on the Panama-Costa Rica boundary near Canas Gordas; follow around the headwaters of the Quebradas Copal and Java and along the Sabana de Limon to a crossing of the Rio Diquis immediately below the confluence of the Rios General and Brus; and thence up the valleys of the Rios General and Pacuar.

One route leaves the Pacuar Valley at a point near San Isidro and rises by developing along the spurs and ravines to a crossing of the Continental Divide at the gap known as Ojo de Agua lying between the headwaters of the Rios Savegre and Grande, the former flowing to the Pacific and the latter to the Atlantic. Thence it follows down the Rio Grande to or near Orosi and thence to Cartago where a junction is made with the existing improved road from Cartago to San Jose.

A second route is identical with the first to the Ojo de Agua gap, but from this point it follows the Continental Divide to a gap known as El Alto through which passes the improved road from Cartago to San Jose.

A third route is identical with the first and second to the point near San Isidro in the Pacuar Valley, but thence it continues to San Marcos in the Parrita Valley and from there it follows more or less the location of the present road between San Marcos and San Jose, passing through the settlements of San Pablo, Los Frailes, and San Miguel Desamparados.

A fourth route is identical with the first three to the point in the Pacuar Valley near San Isidro. It, however, continues up the Rio Pacuar; passes through the gap between this river and the Rio Savegre; follows down this stream to a crossing; goes around and over spurs, and thence down to a crossing of the Rio Naranjo; and meanders up this stream and its tributary, the Quebrada Hondo, to a gap in the ridge between the drainage basin of the Rio Naranjo and that of the Rio Parrita. It then descends to the valley of the Rio Parrita and crosses this stream near San Marcos. Up to this point it is identical with the third route, but leaves it here and ascends the drainage basin of the Rio Parrita to El Jardin at the crest of the Continental Divide which it holds to El Alto, where junction is made with the improved road from Cartago to San Jose.

¹ Includes the holdings of the United Fruit Co.

Three routes were considered from San Jose to the Nicaragua-Costa Rican boundary line. The first is by way of the improved road as far as Naranjo, thence by San Juanillo, Zarcero, Buena Vista, Comandancia de San Carlos, and over the Llanos de San Carlos to the border near the Rio San Juan.

The second is identical with the first as far as Naranjo, but thence it follows more or less the north-eastern slope of the cordillera Guanacaste, skirts along Lake Arenal, and thence develops down the mountain to a point on the border near Lake Nicaragua.

The third is identical with the other two as far as Tacares between Grecia and Naranjo. From there it goes by Palmares, San Ramon, Esparta, Las Canas, Bagaces, Liberia, Santa Rosa, and La Cruz to the Nicaraguan border near Penas Blancas on the Rio Sapoa and near Lake Nicaragua. A modification of this route was considered, leaving San Ramon and skirting the mountains to Miramar and thence to a junction with the route from Esparta to Las Canas at some point in the foothills.

A reconnaissance was made of all the suggested routes with a view to determining the most feasible and practicable. Field investigations began in April 1931 and consisted of a general reconnoitering of the terrain on foot, horseback, and automobile, and of such instrumental work as was necessary with transit, aneroid, clinometer, and compass. The studies evinced the fact that the most feasible route between the Panama-Costa Rican boundary and San Jose is the fourth one considered; or that passing from the Pacuar Valley through San Marcos and El Alto to San Jose.

It was seen that route 1, passing through Ojo de Agua and Orosi, would entail a great amount of heavy side-hill work in developing along the precipitous ridges that flank the Continental Divide; that to rise from a point in the Pacuar Valley at an elevation of 2,200 feet (670 meters) to Ojo de Agua at an elevation of 9,200 feet (2,800 meters) would require approximately 19 miles (30 kilometers) of heavy construction on a continuous 7 percent grade; that the descent from Ojo de Agua to Orosi at an elevation of approximately 3,500 feet (1,069 meters) would necessitate a long stretch of supported grade and about 15 miles (24 kilometers) of heavy earthwork; and that after reaching Orosi it would be necessary to rise again to an elevation of 5,000 feet (1,830 meters) and once more cross the Continental Divide at El Alto. Taking the above into consideration, combined with the fact that there is practically no habitation between the Pacuar Valley and Orosi; that most of the terrain encountered is impracticable for cultivation; and that the route would be longer than the one recommended, it was decided to eliminate it from further study.

Route 2 has objections that are identical with those of route 1 as far as Ojo de Agua, but from this point on to El Alto it is feasible. However, it is not recom-

mended for the reasons set forth in the description of route 1 and because it would be inaccessible to a highly cultivated and thickly populated section contiguous to San Marcos and Santa Maria. It may merit further study when preliminary surveys are made, at which time a further investigation should be made of that section of the Continental Divide between Ojo de Agua and El Jardin where the soil seems to be continually soggy and will probably be difficult to drain properly.

Route 3 is identical with the adopted route as far as San Marcos. It was rejected for the reasons that the terrain between San Marcos and San Jose is very much broken by the cross drainage from the Rios Tarrazu, Alumbre, Jorco, and their tributaries and that if this route were adopted there would be no immediate benefits derived therefrom by the large population contiguous to Cartago.

The first route considered, from San Jose to the Nicaraguan frontier, was abandoned for the reasons that the San Carlos section through which it passes is subject to very intense and almost continuous rainfall; that the construction throughout would be costly; that the approach to Nicaragua is disadvantageous to that country; and that the section through which it passes is not potentially very productive and is thinly populated.

The second route seemed not worthy of much investigation as it follows along the precipitous slopes of the Continental Divide, passes through a country sparsely settled, and enters Nicaragua at an undesirable point. Construction would be costly, service to the Republic would be almost nil except that it would pass through some undeveloped territory, and it would be inaccessible to the population to the northeast and southwest of the Cordilleras.

The third or recommended route passes through the important department of Guanacaste, enters Nicaragua at a convenient point, and throughout its whole length from San Jose to Nicaragua is in a well-cultivated and populous section of the Republic.

Taking the fourth of the previously mentioned routes from Panama to San Jose, and the third from San Jose to Nicaragua, as the recommended general route, we have one that passes through sections of the departments of Puntarenas, Cartago, San Jose, Heredia, Alajuela, and Guanacaste which contain 94 percent of the inhabitants of the country. In addition it passes through most of the larger towns and serves the most highly improved sections as well as those most susceptible of improvement throughout the Republic.

Investigations were carried on throughout practically all sections of the country to the southwest of the Continental Divide and extended sufficiently into the territory to the northwest to determine on which side of the Divide the most practical and economical

route could be located. They consisted of four expeditions of varying periods of time during the years 1931, 1932, and 1933. It was advisable to accomplish the field work in Costa Rica in several trips and to utilize the intervening time for office work in order that further field investigations might serve to eliminate sections of the route offering special difficulties. By this method it is believed that a line has been indicated in Costa Rica that presents a maximum of service with a minimum of heavy construction.

No field work was initiated before a thorough study was made of all available maps and an extended discussion had with Costa Rican officials with a view to determining in a general way the line that would be of most practical use in developing the Republic by connecting the centers of population and utilizing so far as possible the present system of improved roads.

Control points.—The control points selected are as follows:

1. End of the Panama reconnaissance on the Costa Rica-Panama boundary line in a gap between the headwaters of the Rio Piedra Candela, a tributary of the Rio Chiriqui Viejo in Panama, and those of the Rio Brus in Costa Rica.

2. The crossing of the Rio Diquis at Paso Real just below the confluence of the Rios General and Brus.

3. The low point in the ridge between the Rios Pacuar and Savegre.

4. The low gap in the ridge between the Quebrada Hondo and the Rio Parrita. This point is about 2 miles (3 kilometers) east of Mata de Cana.

5. El Alto, the point where the improved road from Cartago to San Jose crosses the Continental Divide.

6. Tacares, near the northern terminus of the improved road between Grecia and Naranjo. Naranjo was eliminated and this point used when it was ascertained that a road was soon to be constructed from Tacares via Palmares to San Ramon. Maps show the line via Naranjo.

7. The crossing of the Rio Barranca near the present crossing of the Pacific Railroad.

8. The crossing of the Costa Rica-Nicaragua boundary line near Penas Blancas on the west bank of the Rio Sapoa, about 2 miles (3 kilometers) upstream from the hacienda Sapoa, on Lake Nicaragua.

The control points selected sufficiently define the line without restricting too much the activities of a locating engineer. Enough data were obtained by inspections and instrumental observations to establish the fact that a line of the required standards of curvature and gradients can be had between the selected control points. Readings were taken with aneroids and compasses and the terrain was examined on horseback and afoot from the Panama-Costa Rica border to the crossing of the Rio Diquis at Paso Real. A stadia line was run up the Rio General from

Paso Real to a ford at the mouth of the Rio Hakum. Inspections and observations were made of the terrain on both sides of the Rios General and Pacuar as far as the gap between the Rios Pacuar and Savegre. The territory from this gap to the gap between the Quebrada Hondo and the Rio Parrita was closely examined on foot. A compass and paced line was run from the Quebrada Hondo-Rio Parrita Gap to San Marcos and from here a stadia line was run to Santa Maria. Stadia and Abney level lines supplemented by aneroid readings were the means of investigating the territory from San Marcos to El Alto. Inspections and investigations were made of the terrain between El Alto and Esparta, notwithstanding the fact that there is an improved road from El Alto to Tacares and from that point to Esparta. Costa Rican engineers have run a preliminary line.

Examinations of the territory from Esparta to the Nicaragua-Costa Rica boundary required little instrumental work other than occasional readings with aneroid and compass. This was principally due to the line following along the foothills bordering the lowlands adjacent to the Gulf of Nicoya and to the fact that the Intercontinental Railway survey passed through this section. The maps of this railway survey were found to be of much assistance and our task consisted to a large extent of the verification of the data shown thereon.

Air photographs were taken of the entire route through Costa Rica. Flights of the planes were controlled and directed by investigations made on the ground so that there would be no unnecessary flying or photographing.

Running description.—The route of the Costa Rican section of the inter-American highway begins at the Costa Rica-Panama boundary line. The boundary is taken as shown on the Pittier map of Costa Rica, where it is defined as the division between the waters of the Rio Chiriqui Viejo in Panama and those of the Rio Brus in Costa Rica. A few miles southeast of Canas Gordas it is on a summit and from this point it runs north about 10° east toward the Atlantic Ocean, following the above-mentioned divide, and south about 45° east toward the Pacific Ocean, following the divide between the Quebrada de la Vuelta in Panama and the streams in Costa Rica which flow west into the Gulf of Osa.

In addition to the two divides which are followed by the boundary line, there is another which begins at the same summit point a few miles southeast of Canas Gordas and extends in a northwesterly direction. This divide lies between the waters of the Rio Brus and those of the Rios Esquinas, Changuena, and Limon, all of which are in Costa Rica. It extends for about 28 miles (45 kilometers) in a direction approximating N. 45° W. and terminates at Paso Real, a

point on the Rio Diquis between the mouths of the Rios Brus and Limon. It is along this divide that the selected route for the highway lies.

In order to get a satisfactory line from the Panama terminus to the Canas Gordas-Paso Real Ridge at or near Platanillo, it will either be necessary to follow the boundary ridge to its junction with the Canas Gordas-Paso Real Ridge and follow this to Platanillo, or cut across the headwaters of the small tributary streams of the Rio Brus.

It is thought that the most feasible line crosses near the headwaters of the Quebradas Java and Copal for, though the terrain is very much broken and irregular here, the elevations are such as to make it practical to get a line of almost any desired limit of grade and curvature. A close study of this territory should be made before the final route is decided upon, as it offers several locations that are feasible and satisfactory.

The Canas Gordas-Paso Real Ridge is heavily wooded, rugged, and cut by many small streams throughout that part between Platanillo and the beginning of the Sabana de Limon.

The Sabana de Limon is that part of the Canas Gordas-Paso Real Ridge which is void of forest growth near its crest and is plainly defined by the Rio Limon on the southwest and the Rio Brus on the northeast. It is slightly rolling, descends gradually to Paso Real, and offers an excellent location for a highway, presenting no difficult alinement, grade, or drainage problems.

There is no well-defined trail from the end of the Panama reconnaissance to the crest of the ridge between Canas Gordas and Paso Real, but along this ridge there is an old trail that can be traveled on horseback. It is said to have been laid out about 1700 by a Spanish priest by the name of Fray Antonio Mergil.

The Rio Diquis is crossed at Paso Real just below the confluence of the Rios General and Brus. At this point it is 300 feet (92 meters) wide and will require a bridge 450 feet (137 meters) in length. The northwestern bank is a high rock bluff and the southeastern bank a gravel bar which extends only a short distance before there is an abrupt rise to the Sabana de Limon. After crossing the Rio Diquis the line follows the valleys of the Rios General and Pacuar as far as the divide between the Rios Pacuar and Savegre.

Immediately after leaving Paso Real it passes over a section of cleared land lying in a large bend in the Rio General which, on account of its peculiar shape, is known locally as "Mano de Tigre" or "Tiger's Hand". In this neck of land many small streams originate, all of which flow into the Rio General. Many of these are crossed by the adopted line, and it may be found after a more thorough investigation and detailed sur-

vey than time permitted in the reconnaissance that a more feasible and practical line could be had either around the headwaters of these creeks or in closer proximity to the Rio General. It seems, however, that unnecessary elevations would have to be attained if the attempt were made to fix the line higher on the Mano de Tigre than shown on the accompanying maps. If the ramifications of the Rio General were followed, the length of the line would be materially increased, and as the banks of this stream are very abrupt and steep at places it would be necessary to stay above them in order that the road be secure from high water and not excessively expensive to construct. This holds true all the way up the Rios General and Pacuar, although after leaving the mouth of the Rio Ceiba there are many more sections of open bottom land with fewer steep cliffs interspersed between them than exist in the lower reaches of the Rio General. A detailed survey will be necessary to determine whether it is advisable to bench the cliffs or go above them.

After passing Terraba, an Indian village on the Mano de Tigre, the route approaches and then follows closely the right bank of the Rio General as far as the confluence of the Rios Pacuar and Buena Vista. From this point it follows the right bank of the Rio Pacuar to the divide between this river and the Rio Savegre. There are no trails along the route after leaving Terraba, but there is a trail that crosses the Rio General near Terraba and leads up the left bank of the Rios General and Pacuar almost to the headwaters of the Pacuar. This trail passes through the villages of Buenos Aires, Palmares, and San Isidro, and at these and several other points trails branch off into the interior mountain sections and to the Pacific coast. These latter cross the route of the highway. There are also trails that lead from Buenos Aires and San Isidro to the Atlantic coast and to Santa Maria de Dota, Orosi, Cartago, et cetera.

Investigations were made of both banks of the Rios General and Pacuar. The right banks were chosen for the line on account of the fact that there are fewer and smaller streams to be crossed than on the left bank. This is evidenced by the fact that the watershed drained by the tributary streams on the west is far smaller than that drained by those on the east. Between the crossing of the Rio Diquis and the divide between the Rios Pacuar and Savegre on the adopted line there are only four streams of any size that have to be crossed, while if the other bank were followed there are numerous ones, such as the Brus, Hakum, Ceiba, Volcan, Penas Blancas, Buena Vista, and Quebrada de la Division, all of which would require bridges varying from 150 to 300 feet (46 to 92 meters) in length.

The valleys of the Rios General and Pacuar offer an excellent approach for a highway to the divide between the Rios Pacuar and Savegre. They are accessible to large sections of territory, some of which are in a state

of cultivation or pasturage, some capable of much development, while others abound in excellent stands of timber of many varieties.

It is well for Costa Rica that nature has provided such a practical route for a line of communication through so large a part of her territory as that comprising the Sabana de Limon and the valleys of the Rios General and Pacuar.

The same cannot be said for that part of the line from the gap in the divide between the Rios Pacuar and Savegre and the gap in the divide between the Quebrada Hondo and the Rio Parrita.

This section offers the greatest difficulties per kilometer of any section in Costa Rica. It is heavily timbered, the mountain slopes are exceedingly steep, sometimes reaching 45°, and the streams are turbulent and in most cases situated in deep gorges or ravines. It will be necessary to clear practically every foot of its length and along that part from the Rio Pacuar-Rio Savegre divide to the crossing of the Savegre almost the entire roadbed will have to be benched as the natural slopes are too steep to retain much fill material. This should not, however, prove excessively costly, for although a great deal of the excavated material will be thrown away it is highly probable that some will be saved as it will make excellent surfacing. Particular attention should be given to drainage through here, for the run-off from the steep mountains onto the road will be very rapid and serious damage will result unless it is immediately confined. Fortunately the mountain ranges contain a large percentage of rock which will prevent scouring in the side ditches and it is anticipated will reduce the volume of earthwork to a minimum for this type of work on account of the fact that cut slopes will stand almost vertical.

The section of line from the crossing of the Rio Savegre to the gap between the Quebrada Hondo and the Rio Parrita presents in many places conditions similar to those that exist between the Pacuar-Savegre Gap and the crossing of the Rio Savegre, but they cannot be accurately determined until a more detailed survey has been made. There are no trails between the Pacuar-Savegre gap and the crossing of the Rio Naranjo. The growth is very thick and the footing is bad which makes exceedingly difficult going.

That part of this section which lies between the crossing of the Rio Naranjo and the Hondo-Parrita Gap is paralleled by an existing pack trail, and there are a few scattered homes along the Rios Naranjo and de los Reyes and the Quebrada Hondo. Some development has taken place through here.

The section of line from the Quebrada Hondo-Rio Parrita Gap, just east of Mata de Cana, to San Marcos is through a territory that presents no particular difficulties although the terrain is somewhat broken. It is through a territory that is served by a number of trails, some of which extend toward the seacoast and

some toward the mountains. There is no heavy growth of timber as most of the land has been cleared for cultivation or pasturage.

The Rio Parrita is crossed near San Marcos, near the site of the present bridge, and from this point begins the ascent to the summit of the Continental Divide near El Jardin.

This section of line lies in a territory which is approximately half timbered and half cleared. Most of it will be side-hill work and the natural slopes of the terrain are not steep except around the point of the ridge to the east of San Marcos and northwest of Santa Maria. It lies entirely within the drainage basin of the Rio Parrita although it passes through a gap in a ridge northwest of Santa Maria that separates the waters of two of the tributaries of the Rio Parrita.

There are roads running from San Marcos to San Jose and Santa Maria, both of which are traversable for automobiles during the dry season. In addition to the roads there are trails leading into all sections of the surrounding territory.

El Jardin, at an elevation of 7,280 feet (2,220 meters) is the highest point in Costa Rica through which the survey passes.

The part of the route from El Jardin to El Alto follows on or near the crest of the Continental Divide. There are long sections immediately on the summit that are adaptable to inexpensive construction, while there are other sections in places where it is necessary to encircle a high point that will present moderately heavy excavation. The territory through here consists of forests and cleared land in approximately equal proportions. It is well served by trails leading out from Cartago toward Santa Maria, San Marcos, and the small villages that lie between San Marcos and San Jose. It is rather thickly populated, very productive, and highly adaptable for livestock. The scenery is magnificent and very extensive views may be had on account of the fact that a great part of the crest of the Continental Divide has been deforested.

The section of the route from El Alto to Tacares is along the improved road which has been constructed from Cartago to Naranjo. It passes through a large part of the productive Meseta Central and serves the important cities and villages of Tres Rios, San Jose, Heredia, Alajuela, and Grecia, from each of which short stretches of road and many trails lead into the contiguous territories.

The route leaves the improved road at Tacares, which is between Grecia and Naranjo, and from here it goes to San Ramon via Palmares. The part from Tacares to Palmares passes through very irregularly formed terrain, but offers no construction difficulties and there exists at present a graded road from Palmares to San Ramon. It is understood that the Costa Rican Government will soon construct the section from Tacares to Palmares which will be included in the inter-

American highway. However, the Government's decision was made after all aerial photography was complete in Costa Rica. Therefore, the route outline is shown by Naranjo as originally planned.

The selected route rises slightly after leaving San Ramon and then there is a gradual descent to the crossing of the Rio Barranca near Esparta. The terrain throughout this section is very irregular, but offers a feasible route with no particular construction difficulties. A preliminary survey has already been run through here, using a maximum grade of 7 percent.

There are numerous trails leading from Palmares, San Ramon, and Esparta into the surrounding country and there exists a road passable for automobiles in dry weather from Palmares to Esparta via San Ramon. It is also possible to drive in dry weather from San Ramon to Naranjo and from Esparta to Puntarenas on the Gulf of Nicoya.

From the crossing of the Rio Barranca to the Costa Rica-Nicaragua boundary line the route leads along the foothills bordering the Pacific Coastal Plains. This section is probably of less interest to the traveler than any other section in Costa Rica, but it passes through a country producing a large amount of rice, corn, beans, and other staples, as well as being highly adaptable to the livestock industry. Many varieties of valuable timber are found here, and there have been rather extensive mining operations in the past.

From Esparta it is possible in extreme dry weather to drive in an automobile as far as La Cruz, near the Nicaraguan frontier. However, this is a laborious undertaking as there are many streams of considerable size that have to be crossed.

There are trails from the villages of Las Canas, Bagaces, Liberia, and others into the surrounding country and to the coast.

Alinement.—The general course of the survey through the Republic of Costa Rica from the Panama border to the Nicaraguan border is approximately N. 50° W., a direction almost paralleling the Continental Divide. The greatest departure from a direct line between these points occurs at Liberia which is approximately 22 miles (36 kilometers) to the southwest.

The general direction from the control point on the Panama border to the one at Paso Real where the Rio Diquis is crossed is approximately N. 57° W.

There will be much curvature through the rugged mountains that give rise to the Quebradas Copal and Java and this will continue along the ridge between Canas Gordas and Paso Real as far as the beginning of the Sabana de Limon since the ridge to this point is irregularly shaped on account of the numerous small streams that indent it. No difficult alinement problems will be encountered between the beginning of the Sabana de Limon and Paso Real.

The general direction from the control point of Paso Real to the one at the Rios Pacuar-Savegre Gap is approximately N. 45° W. Between these points the alinement will be such as is generally found along streams of considerable size. The amount and degree of curvature will be largely determined by the funds available for the construction of the highway.

At no place from the control point at the Panama border to the one at the Rios Pacuar-Savegre Gap should it be necessary to employ curves of less radii than 164 feet (50 meters).

The general direction from the control point of the Rios Pacuar-Savegre Gap to the one at the Quebrada Hondo-Rio Parrita Gap is approximately N. 38° W.

Between these control points will occur the most difficult alinement problems of any section of line in Costa Rica. The descent from the Pacuar-Savegre Gap to the crossing of the Rio Savegre can be made with a continuous gradient much under the maximum allowable and, therefore, quite a degree of latitude will be available for correctly and economically determining the alinement to be used. It is not thought that this should require curves of less than the standard recommended.

The same conditions hold true from the crossing of the Rio Savegre to that of the Rio Naranjo, but from this point to the Quebrada Hondo-Rio Parrita Gap the maximum grade will be necessary and it is probable that this will have to be exceeded in several places if the standard of alinement is to be maintained. This is particularly true near the headwaters of the Quebrada Hondo where the ramifications of many small streams with their intervening ridges make the standard of alinement and grade difficult to maintain. In order to determine to what extent this is true it will be necessary to make a preliminary and possibly a location survey. In case the alinement is sacrificed for gradient, it is recommended that the sharp radii curves be confined to the valleys where slight distance is easier to secure than around the points of ridges.

The general direction from the control point at the Quebrada Hondo-Rio Parrita Gap to the one at El Alto is approximately N. 6° E.

Between these control points there will be no difficult alinement problems. From the Quebrada Hondo-Rio Parrita Gap to the crossing of the Rio Parrita near San Marcos the elevations and topography of the country are such that the alinement can be held to almost any desired standard. And from the Rio Parrita crossing to El Jardin near the summit of the Continental Divide a uniform grade very closely approximating the maximum will probably be used, but the mountains are so much less serrated and scarred in the higher than in the lower altitudes that this adherence to a supported grade will not materially affect the alinement. In some places it may, however,

become necessary to vary the gradients in order to maintain the alinement standard.

From El Jardin to the control point of El Alto where the line follows on or near the crest of the Continental Divide there appears to be no difficulty in securing satisfactory alinement. There are places where narrow ridges jut out from high points on the Divide, and in order to cross them with a desirable alinement it will be necessary to resort to heavy excavation at their crest.

The general direction from the control point at El Alto to the one at Tacares is approximately N. 63° W.

Between these points the road has been constructed. The alinement from El Alto to Alajuela is satisfactory with some exceptions, but from Alajuela to Tacares there are many short radii curves. It would be difficult and expensive to increase some of these radii for by so doing it would in some instances necessitate the construction of a new bridge and its approaches, in others the abandonment of considerable sections of road, and in others a completely revised location over several kilometers of road. The line as it is will serve the present traffic and any anticipated increase for some years. This section of line crosses the Pacific coast drainage at elevations where invariably the streams are close to each other and the intervening ridges unusually high when compared to the distances between streams. It seems advisable, as has been done throughout most of the survey in Central America to adhere either to the lowlands, where stream crossings and the line between are simple problems, or follow along the Continental Divide.

The general direction from the control point at Tacares to the one at the crossing of the Rio Barranca is approximately S. 73° W.

The alinement from Tacares to Palmares will embody a considerable amount of curvature, due to the fact that the line crosses several tributaries of the Rio Colorado. From Palmares to San Ramon will be valley location and no alinement obstacles are anticipated. From San Ramon to the crossing of the Rio Barranca the alinement will be one of much curvature, but it is believed that it will be feasible to adhere to the standard as there is ample terrain for development and the rates of grade can be adjusted to take care of alinement difficulties.

The general direction from the control point at the Rio Barranca to the one at the Costa Rica-Nicaragua boundary is approximately N. 37° W.

This section of line lies almost entirely in the foothills that border the coastal plains and throughout its length as far as the hacienda Santa Rosa there will be no difficulty in securing satisfactory alinement. It crosses the Continental Divide near Santa Rosa at an elevation of approximately 960 feet (293 meters) and from this point it follows the drainage basin of the Rio Sapoa to the Nicaraguan frontier. Along the Rio

Sapoa will be encountered broken terrain and the ramifications of this stream make it difficult to secure the desired alinement without heavy construction work. This can be largely obviated, however, by a carefully made location that gives due consideration to the proper adjustment of alinement and grade within the allowable limits of each.

Gradients.—It is evidenced by the accompanying plans and profile that there is no part of the line in the Republic of Costa Rica where the maximum grade will necessarily be exceeded. There are places, however, such as between the Rio Naranjo crossing and the Quebrada Hondo-Rio Parrita gap at mile 492 (kilometer 792) where it may be advisable to increase the gradients slightly above the maximum in order to obtain satisfactory alinement and keep the costs within reasonable limits. The plan and profile show that it is possible to locate a line with a continuous grade of less than 2 percent from the control point at the Panama-Costa Rica line to the one at Paso Real on the crossing of the Rio Diquis. This would be made possible by placing the line wholly within the drainage basin of the Rio Brus and not following along a ridge. If this were done it would necessitate the construction of many drainage structures and for this reason it seems advisable to hold the ridge location.

The route from Paso Real to the control point in the gap between the Rios Pacuar and Savegre lies wholly within the valleys of the Rios General and Pacuar. The only descending grade of any length throughout this section will be that between Terraba and the Rio Concepcion where there is a drop of 520 feet (159 meters) in 9.7 miles (13 kilometers). There are no places throughout the General and Pacuar Valleys where it will be necessary to use the maximum grade. It may be found advantageous, however, to use short lengths of maximum grade over some of the bluffs and in approaching stream crossings.

The line descends on a grade approximating 5 percent from the Pacuar-Savegre Gap, elevation 3,880 feet (1,183 meters) to the crossing of the Rio Savegre, elevation 1,550 feet (473 meters). It then rises 800 feet (244 meters) on a grade, probably the maximum, to the crest of the ridge between the Rios Savegre and Naranjo, elevation 2,350 feet (716 meters) and then descends 550 feet (167 meters) to the crossing of the Rio Naranjo. Turning up the right bank of this river which with its tributary, the Quebrada Hondo, it follows, the line proceeds to the control gap at mile 492 (kilometer 792), elevation 4,700 feet (1,433 meters). The grade between the Rio Naranjo crossing and the gap at mile 492 (kilometer 792) averages less than 5 percent, but it is highly probable that this will have to be materially exceeded along that part of the line from mile 488 (kilometer 785) to mile 492 (kilometer 792).

From mile 492 (kilometer 792) to mile 495 (kilometer 797) where the line crosses the Rio Parrita, there

is a slight descent and through this section the adjustment of grade will be simple.

After crossing the Rio Parrita the climb begins to the Continental Divide at El Jardin. This section of line will in all probability have grades up to the maximum and this may of necessity have to be exceeded if any pronounced alinement difficulties are found. It is not anticipated, however, that such will be the case as the slopes of the mountains through here are comparatively regular.

Continuing from El Jardin to El Alto there will be sections of ascending and descending gradients, the latter predominating. The crest of the Continental Divide is closely followed through here and there are no parts of it where the maximum grade will be used over a considerable length of line.

There is a paved road from El Alto to Tacares and the gradients along it are held to a maximum of 7 percent except in a few places where this limit is only slightly exceeded.

There is a slight ascent across the drainage basin of the Rio Colorado from Tacares to Palmares and a continual rise with light gradients from this point to San Ramon.

Leaving San Ramon the route ascends to cross the Divide between the Rios Grande and Barranca and then descends the drainage basin of the Rio Barranca to a crossing of this river near Esparta. There will be sections of maximum grade throughout this part of the line, especially between the Divide near San Ramon and the crossing of an eastern tributary of the Rio Barranca near Jesus Maria.

After leaving the crossing of the Rio Barranca there is no part of the line as far as the Nicaraguan frontier where maximum grades need be employed, except that it may be advisable to use them for the improvement of alinement and decreasing construction costs in several places, especially in the valley of the Rio Sapoá where available terrain is somewhat restricted.

Mountains and valleys.—The Costa Rican reconnoitered line commences at an elevation of 3,650 feet (1,113 meters) on the Santa Clara ridge which begins at Cerro Pando, a peak in the Continental Divide, and runs approximately S. 10° W., dividing the waters of the Rio Chiriqui Viejo in Panama from those of the Rio Brus in Costa Rica. It then descends to the beautiful valleys of the Rios Diquis, General, and Pacuar, reaching a minimum elevation of 350 feet (107 meters) at Paso Real. Ascending these valleys it crosses at an elevation of 3,880 feet (1,183 meters) a ridge between the Rios Pacuar and Savegre which begins in the Continental Divide near Cerro Buena Vista and runs approximately S. 45° W. The lowest points between that ridge and the ridge between the Quebrada Hondo and the Rio Parrita which is crossed at an elevation of 4,700 feet (1,433 meters) are the crossings of the Rio Savegre, elevation 1,550 feet (473

meters) and the Rio Naranjo, elevation 1,800 feet (549 meters). The line follows down the Rio Savegre and up the Rio Naranjo and its tributary, the Quebrada Hondo, all of which are beautiful, turbulent streams confined in narrow, deep gorges.

There is a slight descent from the Quebrada Hondo-Rio Parrita gap to the crossing of the Rio Parrita, elevation 4,450 feet (1,357 meters) and thence begins the rise to the summit of the Continental Divide at El Jardin, elevation 7,280 feet (2,220 meters). There is magnificent scenery at this point which continues to El Alto, elevation 5,130 feet (1,564 meters) where the Continental Divide is left and the line passes over undulating ground to Tacares, elevation 2,710 feet (826 meters). A gradual ascent to the gap, elevation 4,380 feet (1,335 meters) near San Ramon, and thence a descent to the crossing of the Rio Barranca, elevation 150 feet (46 meters) brings the line again into the low altitude which it left at Paso Real.

There are no prominent mountains crossed between the Rio Barranca and the Nicaraguan boundary until the summit of the Continental Divide is reached near Santa Rosa at an elevation of 960 feet (292 meters). From this point the drainage basin of the Rio Sapoá is followed to the crossing of the Costa Rica-Nicaragua boundary line near Penas Blancas at an elevation of 140 feet (43 meters).

From the above it will be seen that the recommended line passes through varying elevations, from 140 feet (43 meters) to 7,280 feet (2,220 meters) and in so doing taps cultivated and timbered lands in both the lowlands and highlands, thereby giving access to the diversified agricultural, forest, and mineral products that are found so generously distributed throughout the Republic. It touches the valleys and the mountains, the foothills and coastal plains, and passes through the Meseta Central which is the most richly endowed section of the Republic with flat agricultural lands, unsurpassed climate, and natural beauty.

Principal drainage.—The entire route is drained by streams flowing to the Pacific Ocean with the exception of short sections along the Continental Divide between El Jardin and El Alto and the section from Santa Rosa to the Costa Rica-Nicaragua boundary. The principal streams crossed below an elevation of 1,800 feet (549 meters) are the Rios Diquis, Savegre, Naranjo, Barranca, Ciruelias, Aranjuez, Guacimal, Lagartos, Abangares, Tenorio, Blanco, Ahogados, and Tempisque. Those crossed above 1,800 feet (549 meters) are along the improved road between El Alto and Tacares, and between the latter point and San Ramon, and are all tributaries of the Rio Grande de Tarcoles.

Throughout the route there will be many crossings of small streams and ravines that are dry during the dry season, but need openings of considerable size to take care of the flow during the rainy season when some of them become streams of considerable size.

The sections requiring fewer and smaller drainage structures are along the Sabana de Limon and the Continental Divide between El Jardin and El Alto. The one requiring the most elaborate drainage system is from Esparta to the Nicaraguan boundary. However, the streams through this section have banks of considerable height which, combined with accessible construction materials and good foundations, considerably lighten the bridge costs.

Soil conditions.—There are naturally many varieties of soil to be found along the route. A black soil of very little depth and underlain with clay is found from the Panama border to Paso Real and thence across the Mano de Tigre to the bank of the Rio General. This is very hard when dry, does not seem to wash excessively, and becomes very slippery when wet.

The valleys of the Rios General and Pacuar are composed largely of red clay, but not infrequently there is found sandy loam, particularly along the bottom lands. Small and large boulders are strewn promiscuously about and practically all of the stream beds contain immense quantities. Stone ledges outcrop at many points along the banks of the streams and their quality seems to be very good, somewhat resembling granite.

The soil in the wooded area between the Rio Pacuar-Rio Savegre and Quebrada Hondo-Rio Parrita Gaps consists of a black leaf mold overlying a rather unstable material composed of clay and sand mingled with loose rock that presumably has come from disintegrating ledges. Judging from the steepness of the natural slopes there is every reason to believe that rock ledges underlie the surface material and this is borne out to some extent by the appearance in the Rio Savegre section of bare-faced ledges varying in depth from 200 to 500 feet (60 to 150 meters). Whether this holds good throughout this area has not been established, but is very probable.

A clay overlain with a dark soil of varying depths is found from the Hondo-Parrita gap to El Jardin except in the cleared areas where the topsoil seems to have washed away, leaving the clay exposed. There are many boulders of varying sizes distributed over this area and along the Rio Parrita will be found outcropping ledges.

Clay with a small percentage of sand is the dominating material between El Jardin and El Alto. In the wooded areas this is covered with a leaf mold. The rock in the higher altitudes appears to be of igneous origin and occurs principally on the high points along the Divide. Ledges are undoubtedly present, but being covered by earth they are seldom seen. A rich dark soil overlies the subsoil throughout practically

the entire area from El Alto to San Ramon. This varies in depth with the altitude and with the amount of erosion to which it has been subjected. It is more abundant throughout sections where gentle slopes occur, as around Tres Rios and San Jose, and is almost lacking on the steep cleared slopes that border some of the streams.

Rock occurs in ledges in many places and the streams abound in boulders which are also frequently found in large quantities both in the cleared and wooded areas. They are principally of volcanic origin.

The soil throughout the territory adjacent to the line from San Ramon to the Costa Rica-Nicaragua boundary line is of divers kinds and qualities. All of the strata that form the western slope of the Continental Divide between the elevations of 4,380 feet (1,335 meters) and 150 feet (46 meters) are crossed in descending from the gap near San Ramon to the crossing of the Rio Barranca. Vari-colored clays containing different percentages of sand predominate and overlying these in varying qualities and thicknesses are molds and loams, particularly in the wooded areas. The clays will make stable subgrades, but are disposed to wash when the percentage of sand is high. There is an abundance of stone, both igneous and sedimentary, occurring in ledges and boulders.

Along the foothills and plains areas between the crossing of the Rio Barranca and the Nicaraguan line there is found a slate-colored topsoil that overlies volcanic tufa under which is frequently found a hard volcanic lava. The upper stratum has probably been formed, partly by the disintegration of underlying strata, and partly by deposit from the mountain ranges. When dry it is hard and unyielding, but becomes quaggy when wet. Through this section it is recommended that particular attention be given to drainage and in order that this can properly be taken care of it is strongly advised that an undulating grade line be used. Stone occurs in the streams in the form of volcanic boulders, but there seem to be no workable ledges in close proximity to the line. Along the line between Bagaces and Las Canas there was noticed a deposit that appeared to contain lime and seemed very compact and firm even though it was seen during the wet season. The most probable sources for surfacing materials and masonry are the many rivers that cross the line.

Existing roads used.—Costa Rica has only one section of improved road of any great length. This lies between Cartago and Naranjo and the recommended route of the inter-American highway makes use of all of it except short sections at either end. Some sections of it are paved with concrete, while others are of

asphalt surfacing. In general it is 18 feet (5.5 meters) wide, the concrete sections are 4 inches (10 centimeters) in thickness, and the asphaltic surfacing is 6 inches (15 centimeters) in depth. This is not adequate for very heavy traffic units and it is understood that their use is not allowed.

Materials.—All along the line is found an ample supply of construction timbers and surfacing materials. These vary in quantity and quality and should be carefully studied before being put to use. This is particularly true of the surfacing materials as they occur in so many grades that it is difficult to determine the best by observation. Almost all stream beds contain boulders, gravel, and sand which usually are of igneous or sedimentary origin. Little sand is found in the upper reaches of streams, due undoubtedly to the fact that it has been carried away by the swift currents prevalent during wet seasons.

The roble, carbonero, guayava, sigua, cedro, and caoba are local names of the trees used for the manufacture of lumber. They vary greatly in their usefulness, however. Some will withstand the ravages of insects in certain altitudes, while others yield very rapidly when attacked. Some will resist the alternate wetting and drying so inevitable in the Tropics, while others seem almost to decay overnight.

Estimates of cost.—Tables 19, 20, and 21 itemize the estimated costs on the principal phases of the operations in Costa Rica.

The mileage of the proposed highway in Costa Rica is as follows: 312.7 miles (503.2 kilometers) contemplated construction; 43.6 miles (70.2 kilometers), from El Alto to Naranjo, already completed; or a total of 356.3 miles (573.4 kilometers).

Estimates for type 1, table 19, contemplate the construction of 312.7 miles (503.2 kilometers) of road with a graded section of 28 feet and a surface of local materials 6 inches deep compacted and 18 feet wide. All bridges are to be 20-foot roadway on the new portion of highway.

Estimates for type 2, table 20, contemplate the construction of 312.7 miles (503.2 kilometers) of road with a 28-foot graded section and a surfacing of local materials 18 feet wide and a 6-inch compacted depth with an oil-treated surface. All bridges are to be 20-foot roadway on the new portion of highway.

TABLE 19.—*Estimates for type 1*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	312.7	Miles.....	\$500.00	\$156,350.00
Unclassified excavation.....	6,000,000.0	Cubic yards.....	.75	4,500,000.00
Small drains.....	210,400.0	Linear feet.....	10.00	2,104,000.00
Bridges.....	6,560.0	do.....	200.00	1,312,000.00
Surfacing.....	733,800.0	Cubic yards.....	2.50	1,834,500.00
Total.....				9,906,850.00
Add 12½ percent for engineering and contingency.....				1,238,356.25
Total estimate.....				11,145,206.25

TABLE 20.—*Estimates for type 2*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	312.7	Miles.....	\$500.00	\$156,350.00
Unclassified excavation.....	6,000,000.0	Cubic yards.....	.75	4,500,000.00
Small drains.....	210,400.0	Linear feet.....	10.00	2,104,000.00
Bridges.....	6,560.0	do.....	200.00	1,312,000.00
Surfacing.....	733,800.0	Cubic yards.....	2.50	1,834,500.00
Oil.....	1,651,056.0	Gallons.....	.20	330,211.20
Total.....				10,237,061.20
Add 12½ percent for engineering and contingency.....				1,279,632.65
Total estimate.....				11,516,693.85

Estimates for type 3, table 21, contemplate bringing the highway in Costa Rica to a 32-foot graded roadway with an 8-inch-thick, 20-foot-wide, concrete pavement. Existing bridges between El Alto and Naranjo are to be widened to 20 feet or replaced and all small drains are to be lengthened. Estimates for this type do not contemplate using any of the already constructed road as the concrete sections are only 4 inches thick.

Principal stream crossings in Costa Rica are shown in table 22 and the length of span is indicated for bridges not yet constructed.

TABLE 21.—*Estimates for type 3*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	312.7	Miles.....	\$500.00	\$156,350.00
Unclassified excavation.....	7,500,000.0	Cubic yards.....	.75	5,625,000.00
Small drains.....	235,000.0	Linear feet.....	10.00	2,350,000.00
Bridges.....	8,500.0	do.....	175.00	1,487,500.00
Surfacing.....	928,874.0	Cubic yards.....	15.00	13,933,110.00
Total.....				23,551,960.00
Add 10 percent for engineering and contingency.....				2,355,196.00
Total estimate.....				25,907,156.00

PROPOSED INTER-AMERICAN HIGHWAY

TABLE 22.—Principal stream crossings

Name of stream	Length of bridge span	
	Feet	Meters
Brazo Coto Bruz.....	40	12
Quebrada Copal.....	100	30
Quebrada Java.....	100	30
Rio Diquis.....	450	137
Rio Concepcion.....	100	30
Quebrada Ladino.....	50	15
Rio Pejivallal.....	125	38
Rio Pacuarito.....	80	24
Rio Pacuar.....	40	12
Rio Savegre.....	350	107
Rio Naranjo.....	300	92
Rio Parrita.....	80	24
Rio Torres.....		
Rio Varillo.....		
Rio Bermudez.....		
Rio Segundo.....		
Rio Alajuela.....		
Rio Itiquis.....		
Rio Poas.....	(1)	(1)
Rio Tacares.....		
Rio Pilas.....		
Rio Aguacate.....		
Rio Vigia.....		
Rio Sarchi.....		
Rio Laguna.....		
Rio Colorado.....		
Rio Grande.....	175	53
Rio Barranca.....	300	92
Rio Naranjo.....	125	38
Rio Ciruelitos.....	125	38
Rio Mico.....	175	53
Rio Aranjuez.....	200	61
Rio Guacimal.....	200	61
Rio Lagartos.....	150	46

¹ Existing.

TABLE 22.—Principal stream crossings—Continued

Name of stream	Length of bridge span	
	Feet	Meters
Rio Coyolito.....	100	30
Rio Canamazo.....	100	30
Rio Congo.....	100	30
Rio Abangares.....	200	61
Rio Soledad.....	70	21
Rio La Palma.....	70	21
Rio Las Lajas.....	70	21
Quebrada Reventado.....	60	18
Rio Higueron.....	125	38
Rio de las Canas.....	100	30
Rio Tenorito.....	200	61
Rio Blanco.....	200	61
Rio Agua Caliente.....	100	30
Rio Ceiba.....	100	30
Rio El Estanque.....	100	30
Rio Bagaces.....	100	30
Rio de las Piedras.....	150	46
Rio Potrero.....	70	21
Rio Pijige.....	70	21
Rio Salto.....	100	30
Rio La Carana.....	60	18
Quebrada Arena.....	60	18
Rio de Liberia.....	100	30
Quebrada Panteon de Liberia.....	60	18
Quebrada Clara.....	80	24
Rio Santa Ines.....	60	18
Rio Blanco.....	100	30
Rio Jirigarayes.....	80	24
Rio de los Ahogados.....	150	46
Rio Tempisque.....	200	61
Rio de las Vueltas.....	120	37
Quebrada Cabalzeta.....	40	12
Total.....	6,560	1,989

COSTA RICA



DEPARTAMENTO	CAPITAL
A GUANACASTE	LIBERIA
B PUNTARENAS	PUNTARENAS
C ALAJUELA	ALAJUELA
D HEREDIA	HEREDIA
E SAN JOSÉ	SAN JOSÉ
F CARTAGO	CARTAGO
G LIMÓN	LIMÓN

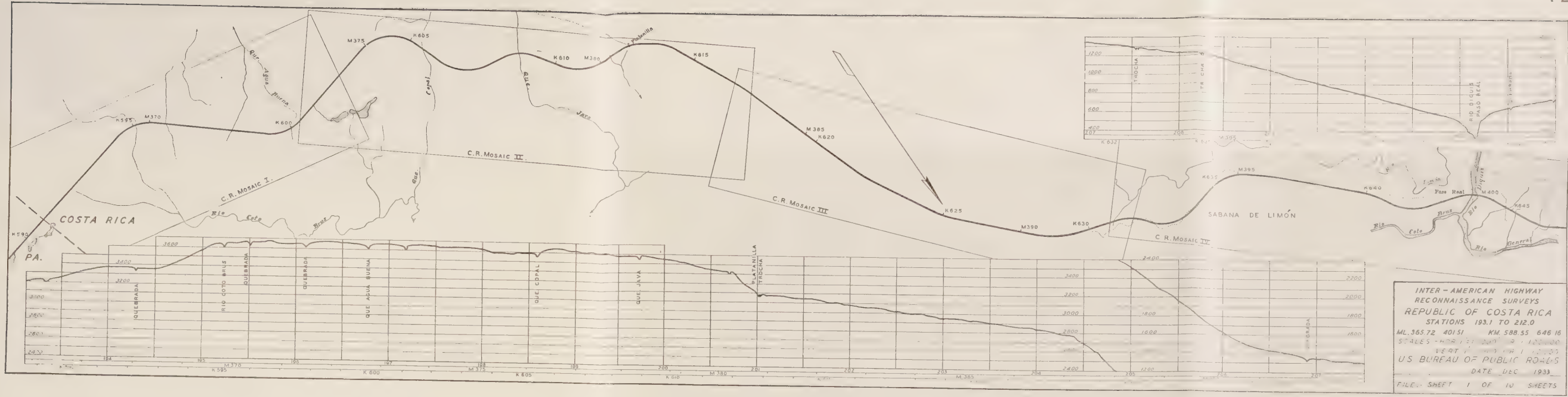


PLATE 18.



PLATE 19.

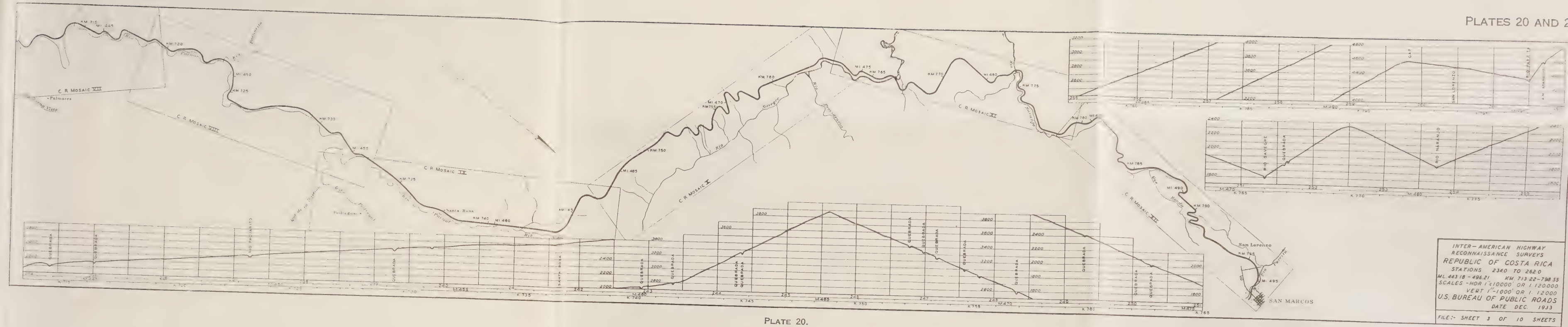


PLATE 20.

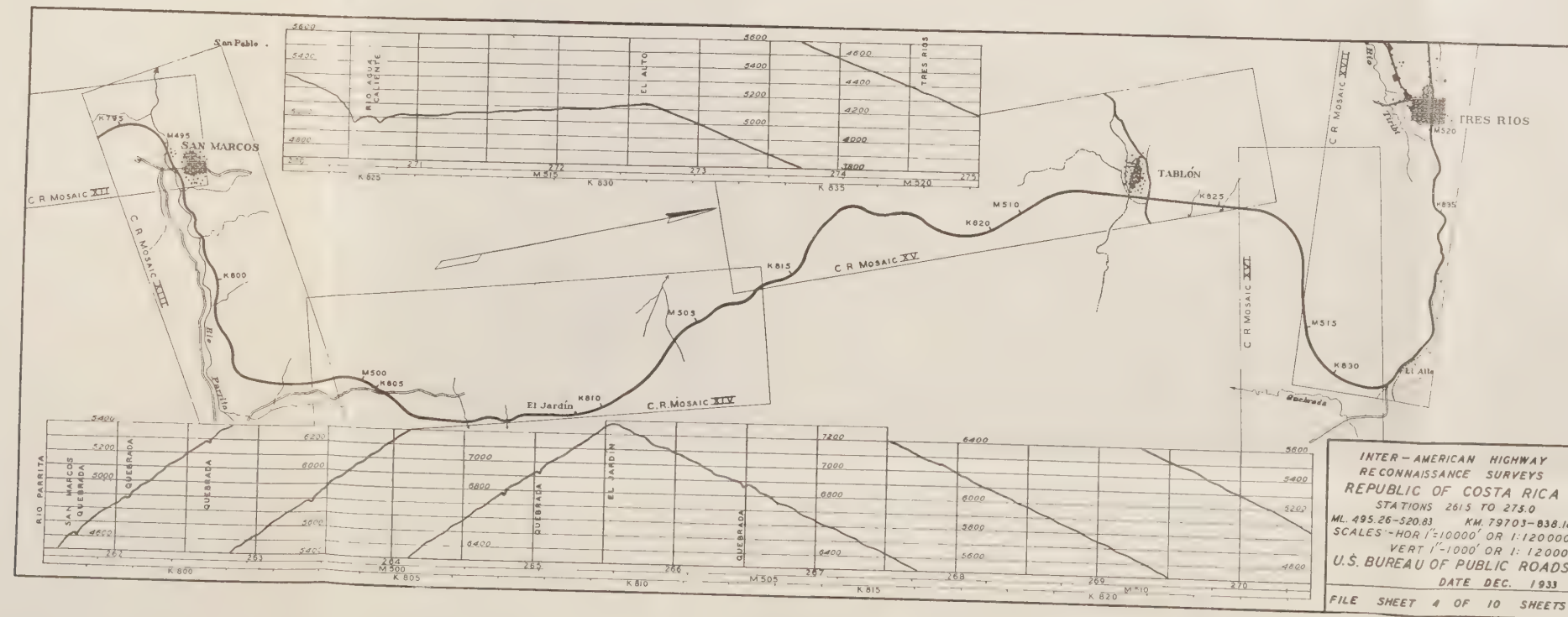


PLATE 21.

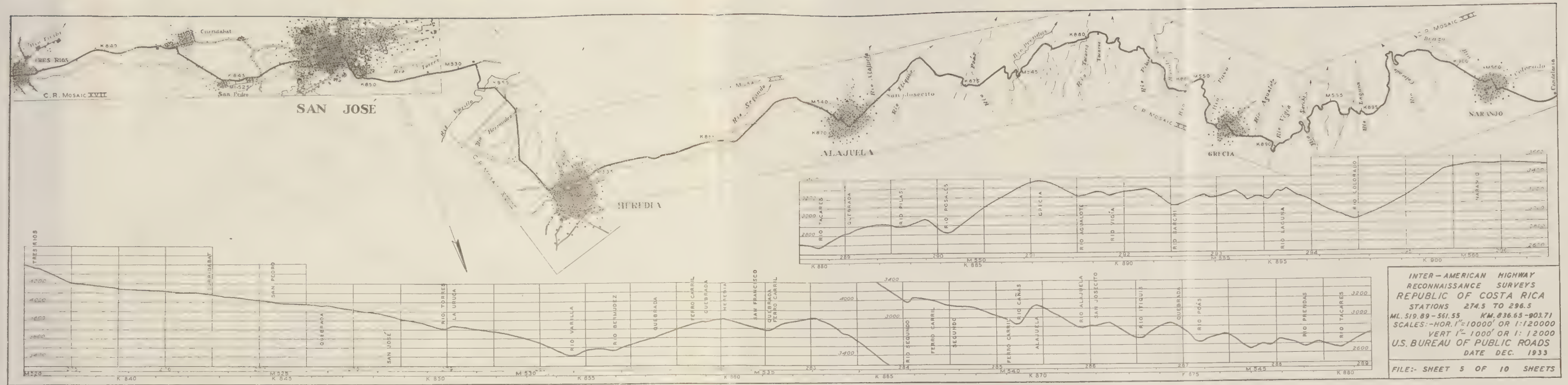


PLATE 22.

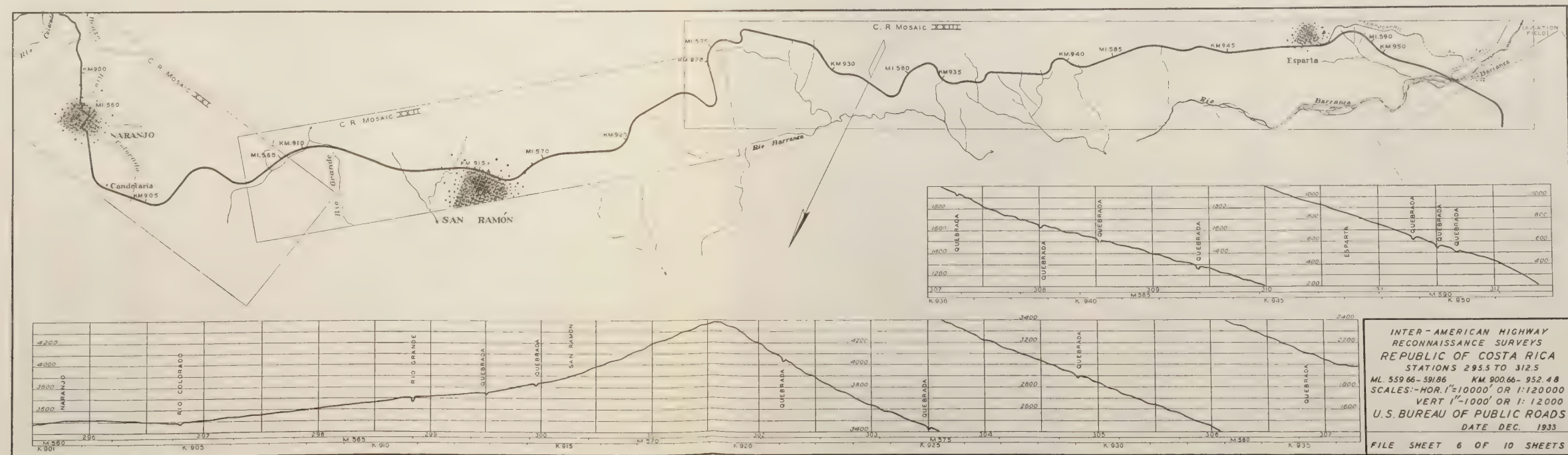


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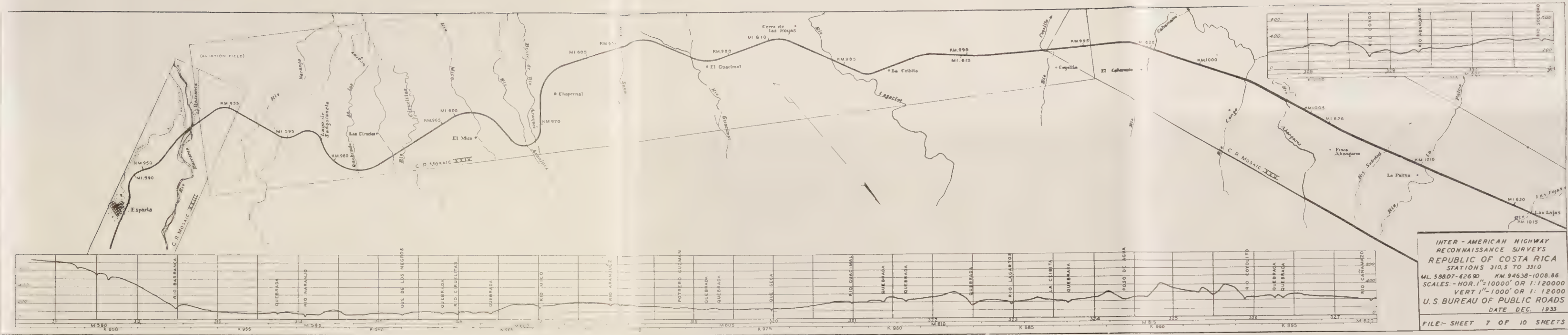


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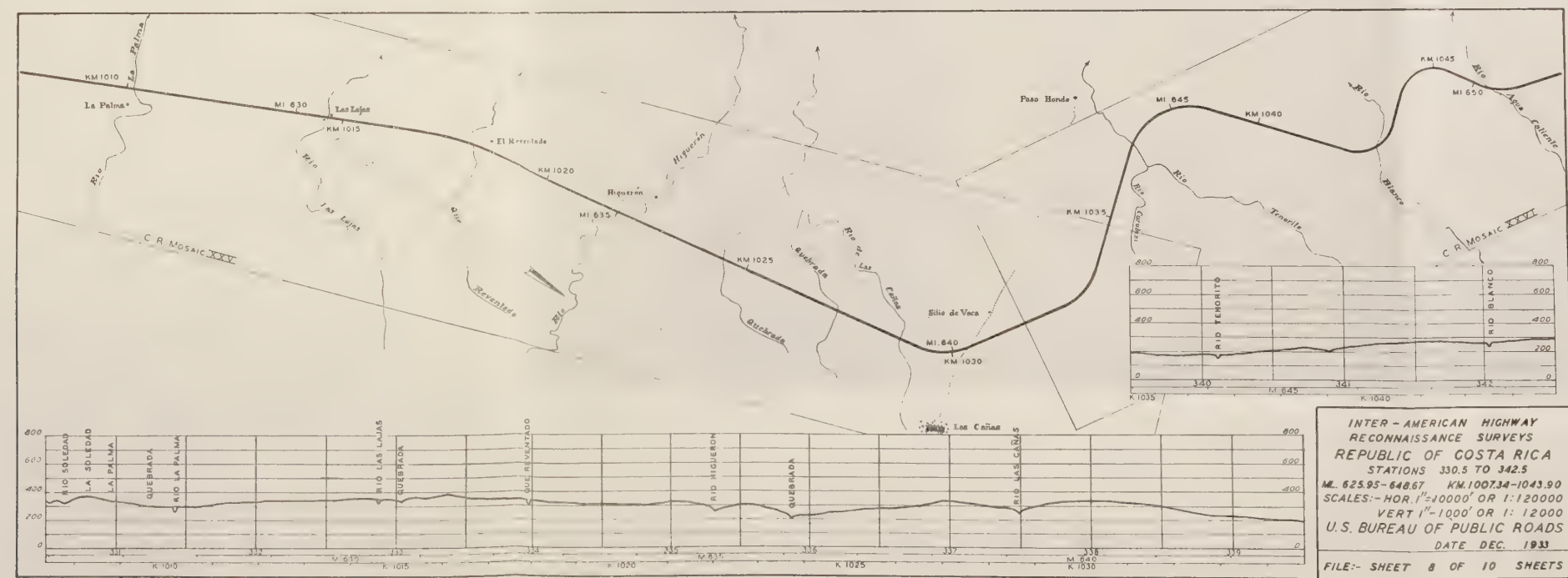


PLATE 25.



PLATE 26.



PLATE 27.

PROPOSED INTER-AMERICAN HIGHWAY

REPORT OF A RECONNAISSANCE SURVEY FOR THE
PROPOSED INTER-AMERICAN HIGHWAY

PART IV.—REPUBLIC OF NICARAGUA

BUREAU OF PUBLIC ROADS
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

NICARAGUA

GENERAL SECTION

HISTORY

Columbus was the first European to visit Nicaragua when in September 1502 he took refuge from a tempest and cast anchor to leeward of a point named by him and still known as Cape Gracias a Dios. The country derives its name from an Indian chieftain, Nicarao, with whom Gil Gonzales, an emissary of Panama's governor, Pedrarias, made a treaty in 1522.

Up to 1822 Nicaragua was a part of the Captaincy-General of Guatemala, or Central America. As such it became a part of the Mexican Empire under Agustin I, where it remained until 1824 when it became a part of the Central American Federation. Nicaragua broke away from this Federation in 1838.

In 1842 Nicaragua joined in the attempt at Chinandega to create a Central American Confederation. This was abandoned in 1863. Nicaragua declined to become a party to the attempt of President Barrios of Guatemala in 1885 to reweld the Central American States. Nicaragua was a signatory to the Amapala Agreement of 1895 to establish the Greater Republic of Central America, which collapsed in 1899. It refused to become a party to the treaty of San Jose in 1921, providing for a Federation of Central America, fearing that the acceptance of such a compact might jeopardize certain rights which it had acquired under the Bryan-Chamorro Treaty of 1916.

A prolonged dispute with England was settled when the latter ceded to Nicaragua its protectorate over the Mosquito Indians. Not until 1850 did Spain acknowledge Nicaragua's independence.

In 1914 Secretary Bryan negotiated a treaty with Minister Chamorro of Nicaragua (ratified in 1916) by which the United States paid Nicaragua \$3,000,000 and in return was granted the exclusive right to construct and maintain an interoceanic canal across Nicaragua, and a lease on Great and Little Corn Islands near the eastern terminus of the proposed canal.

Nicaragua has had a number of constitutions, that of 1912 being the one now in force.

GEOGRAPHY, TOPOGRAPHY, AND AREA

Nicaragua is the largest of the Central American republics, containing approximately 49,200 square miles (127,500 square kilometers). It lies between 10°45' and 15°10' north latitude, and 83°11' and 87°38' west longitude. It is bounded on the north by Honduras, on the east by the Caribbean Sea, on

the south by Costa Rica, and on the west by the Pacific Ocean.

The Continental Divide extends throughout the country from northwest to southeast, passes much nearer the Pacific Ocean than the Atlantic Ocean, and is scarcely 10 miles (16 kilometers) from the former at several points along the narrow strip of land southwest of Lakes Managua and Nicaragua. In and near this range there are many volcanic peaks, so located that a line passing through their summits would almost parallel the Pacific coast. The more important of these are El Madero, El Omotepe, Zapatera, Mombacho, Masaya, Santiago, Momotombo, Momotombito, Asososca, El Viejo, Santa Clara, and Telica.

Geographically and topographically Nicaragua is rather unusual. Like other Central American countries, with the exception of El Salvador, it has more area on the Atlantic than on the Pacific side of the Continental Divide, but in Nicaragua the Atlantic side comprises more than 60 percent of the total area of the country and consists of mountain ranges that average higher than the Divide.

The Rio San Juan is the only stream that flows to the Atlantic Ocean through the mountain ranges lying east of Lakes Nicaragua and Managua. Through this stream and the aforementioned lakes, a large area of the country has water communication with the Atlantic Ocean by means of moderate-sized craft. This river marks the general line of all surveys for an interoceanic canal in Nicaragua.

To the east of the mountains of central Nicaragua along the Caribbean Sea there is a vast coastal plain area traversed by several important rivers, some of which are navigable for small craft.

Lakes Managua and Nicaragua are two beautiful bodies of water extending from southeast to northwest. The area drained by them is elliptical in shape; the major axis approximates 230 miles (370 kilometers), 70 miles of which are in Costa Rica; and the minor axis approximates 65 miles. A line joining the centers of the lakes very nearly parallels the Pacific coast and is about 40 miles distant therefrom.

Lake Managua has a maximum length of nearly 38 miles. Its width varies from 6 miles, between Punta Chiltepe and the northwestern coast line, to about 20 miles at its widest point. It is the shallower of the two lakes, and is connected with Lake Nicaragua by the Rio Tipitapa, a stream about 15 miles long, the upper part of which at certain seasons of the year is practically

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The Rio San Juan is the only stream that flows to the Atlantic Ocean through the mountain ranges lying east of Lakes Nicaragua and Managua. Through this stream and the aforementioned lakes, a large area of the country has water communication with the Atlantic Ocean by means of moderate-sized craft. This river marks the general line of all surveys for an interoceanic canal in Nicaragua.

To the east of the mountains of central Nicaragua along the Caribbean Sea there is a vast coastal plain area traversed by several important rivers, some of which are navigable for small craft.

Lakes Managua and Nicaragua are two beautiful bodies of water extending from southeast to northwest. The area drained by them is elliptical in shape; the major axis approximates 230 miles (370 kilometers), 70 miles of which are in Costa Rica; and the minor axis approximates 65 miles. A line joining the centers of the lakes very nearly parallels the Pacific coast and is about 40 miles distant therefrom.

Lake Managua has a maximum length of nearly 38 miles. Its width varies from 6 miles, between Punta Chiltepe and the northwestern coast line, to about 20 miles at its widest point. It is the shallower of the two lakes, and is connected with Lake Nicaragua by the Rio Tipitapa, a stream about 15 miles long, the upper part of which at certain seasons of the year is practically

lost among the lava rocks through which it cuts its way to the lower lake. The elevation of the surface of the lake varies with the seasons but averages 127 feet above sea level.

Lake Nicaragua is elliptically shaped, its maximum length being about 105 miles (170 kilometers) and its width about 40 miles (65 kilometers). It covers an area of about 2,600 square miles and is from 80 to 90 feet deep. The surface of its water, while varying at times, averages about 105 feet above sea level.

Many streams empty into the lakes from the northeast, while fewer and smaller ones enter them from the southwest.

CLIMATE AND RAINFALL

Along the coastal plains and in the lower elevations of the interior the temperature is high throughout the day, moderating somewhat in the late afternoons and during the night. The variation throughout the year is probably not more than 20°.

In the higher altitudes of the central mountain area it is very pleasant, becoming excessively hot only for short periods during the middle of the day.

From the best information obtainable it seems that the temperature variations in the lower altitudes are from 70° to 90° F., and in the higher, from 60° to 80° F.

The two seasons of the year are wet and dry. The former extends from June to October on the Pacific coast and frequently from June to March on the Atlantic coast. Very frequently there occurs in August a "veranillo" (little spring) during which there is no rainfall.

The average annual precipitation on the Pacific coast is approximately 75 inches, while on the Atlantic littoral it is about double that amount.

POPULATION

The last census of Nicaragua was in 1920, the total population for the country being recorded as 638,119, distributed departmentally as follows:

TABLE 1.—Area and population of Nicaragua by departments, 1920

Department	Area (square miles)	Population
Bluefields.....	18,920	31,078
Carazo.....	320	32,659
Chinandega.....	1,550	47,583
Chontales.....	5,470	77,641
Estell.....	675	30,515
Granada.....	470	34,035
Jinotega.....	5,130	27,205
Leon.....	2,060	78,300
Managua.....	1,165	74,696
Masaya.....	200	40,386
Matagalpa.....	2,950	78,226
Nueva Segovia.....	1,850	42,685
Rivas.....	740	31,090
Cabo Gracias a Dios (district).....	4,860	11,728
San Juan del Norte (district).....	590	892
Total.....	46,950	638,119

TABLE 2.—Population of principal cities

	Population
Bluefields.....	5,068
Chinandega.....	10,780
Diriamba.....	5,576
Granada.....	16,763
Leon.....	28,318
Managua.....	27,839
Masaya.....	13,258
Matagalpa.....	4,471
Total.....	112,073

Just prior to the earthquake of March 31, 1931, the population of Managua was estimated to be over 50,000. Some estimates of the total population of the country run as high as 800,000. According to W. W. Cumberland, "No exact count has ever been made of the population of Nicaragua. Conditions are such that accurate enumeration would be an impossibility."

About 88 percent of the population is rural and 12 percent urban and suburban. No data are available from which to estimate the number engaged in agriculture, livestock raising, mining, and manufacturing.

ECONOMIC SECTION

National wealth.—Official Nicaraguan statistics, never profuse, and economic data concerning the country are now well-nigh nonexistent in Managua, the capital, as all records were destroyed in the earthquake of March 31, 1931, and the resulting fire which swept the city and burned the government buildings. Fortunately, there has been preserved by far the best and most accurate economic study of Nicaragua yet attempted and of fairly recent date, namely, "Nicaragua, an Economic and Financial Survey Prepared at the Request of Nicaragua Under the Auspices of the Department of State", by W. W. Cumberland.¹

The Cumberland survey gives the area of Nicaragua as 47,000 square miles,² or some 30,000,000 acres, of which it is estimated that two-thirds "is capable of some economic utilization." Of this 20,000,000 acres (in round numbers) of cultivable area, no more than 5 percent, or 1,000,000 acres, is utilized for agricultural purposes. A nominal value of 50 cents an acre is given to the uncultivated and \$22 to the cultivated land since "cultivated land is not expensive in Nicaragua in comparison with standards which exists in other countries." Fenced grazing land, about 600,000 acres, is given a value of \$5 an acre, or \$3,000,000. Total rural lands are estimated to be worth \$35,000,000, consisting of \$25,000,000 for land in some stage of cultivation or utilization, and \$10,000,000 for waste land and for cultivable land not rendering economic service. The Cumberland survey gives the gross wealth of the country as shown in table 3.

¹ U.S. Government Printing Office, Washington, D.C., 1928.

² The U.S. Department of Commerce estimates the area to be 49,500 square miles. In practically all the Latin American countries there is much uncertainty with respect to exact areas, due to inaccurate surveys.

TABLE 3.—*Gross wealth, 1928*

	<i>Value</i>
Cultivated land and improvements.....	\$22, 000, 000
Grazing land.....	3, 000, 000
Uncultivated land (public and private).....	10, 000, 000
Forest and lumbering equipment.....	15, 000, 000
Mineral deposits and mining developments.....	5, 000, 000
Urban land and improvements.....	20, 000, 000
Livestock and annual crops.....	25, 000, 000
Pacific Railway.....	4, 500, 000
National Bank.....	500, 000
Currency reserve.....	2, 300, 000
Other property and assets of the Government....	1, 050, 000
Total.....	108, 350, 000

Early in 1931 occurred the Managua earthquake. Bandit disturbances that year were so pronounced as to discourage certain industries, principally lumber, from further operation, and coffee prices materially decreased. These troubles are estimated to have lowered Nicaragua's gross national wealth by, roughly \$10,000,000. In 1932 the external funded debt was \$2,373,781 and the internal debt, funded and held in the United States, was \$1,117,750. This would leave the net wealth of Nicaragua in 1932 (\$108,350,000 minus these three items) at approximately \$95,000,000, or nearly \$149 per capita. Subtracting from the total net wealth the estimated value of foreign investments \$20,000,000, the net wealth of the Nicaraguan people per capita, would be about \$117.

EMPLOYMENT AND WAGES

Cumberland estimated the annual income of Nicaragua at \$25,000,000, which, on the basis of officially reported population, would be in the neighborhood of \$40 per capita per year.

According to Cumberland, this includes not only monetary income but the value of commodities which are produced and consumed without entering into commercial transactions.

It is to be remarked that the larger agricultural, lumbering, and mining activities, as well as numerous commercial houses, are foreign-owned, and net income from these enterprises is in general remitted abroad. About 125,000 persons are believed to be gainfully employed, which, on the basis of national income, would indicate an average annual income of \$200 for the employed, the conventional number of five to a family being accepted even for Nicaragua. Labor will not average over 50 cents a day and many, such as the servant class, work for much less. Some of the skilled laborers may receive as high as \$1 a day. Corn, rice, beans, bananas, and cheese make up the staple diet of the population and the prices of these staples are very low.

PRODUCTS AND INDUSTRIES

Agriculture.—A map in Nicaragua, a Commercial and Economic Survey, Trade Promotion Series No. 54,

published in 1927 by the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce shows that the agricultural areas of Nicaragua are divided into four sections:

Section 1: A belt of land about 25 miles wide bounded on the southwest by the Pacific Ocean, and on the northeast by the lakes and the chain of volcanoes extending from the lakes northward. This section is subdivided locally into unofficial districts known as the eastern district (*distrito del oriente*), comprising the coastal parts of the Departments of Rivas, Granada, Carazo, Masaya, and Managua (the principal coffee region); and the western district (*distrito del occidente*), comprising the coastal parts of the Departments of Leon and Chinandega, devoted principally to producing cattle, corn, and sugar cane. Probably 50 to 65 percent of the population lives in this section. The eastern district is a plateau rising from the lakes to elevations of 2,000 and 2,500 feet and falling in the southern part of the department of Rivas to a low gap which forms the projected course of the proposed Nicaraguan Canal. This district produces cacao, tobacco, rice, sugar, and cattle, as well as 80 percent of the coffee, the country's principal crop. The western district, a plain sloping from the volcanoes to the sea and having a maximum elevation of 500 feet, produces sugar cane, cattle, dyewood, and the greater part of the country's large consumption of corn.

Section 2: This area has the form of an isosceles triangle, with its apex at the head of the Rio San Juan. It is bounded on the southwest by section 1 and on the east by a line drawn from the apex to the border and passing some 20 or 30 miles east of Matagalpa. Here most of the large rivers emptying into the Atlantic Ocean have their origin. The large cattle ranges are in this belt, the Chontales plains northeast of Lake Nicaragua being in normal times devoted to cattle, while the Matagalpa region with some of the area northward to the border produces about 20 percent of the coffee, agricultural products for its own needs, and some gold and silver. Beginning as rolling prairie, the land in this section becomes steeper along the watershed, rising to elevations of 2,000 and 3,000 feet and having outstanding mountains with heights of 4,000 and 5,000 feet.

Section 3: This is a similar and contiguous triangle to the eastward and is largely an uninhabited wilderness of timbered plains and rolling hills cut by large rivers. Its mahogany has been exploited for about a century and to such an extent during recent years that the supply near the streams has been considerably depleted. Much still remains near the headwaters and there are cedar and hardwoods in great quantity, while of recent years considerable exploitation has taken place of the wide pine belt extending westward along the border from Cabo Gracias. The only other development of this section has been the partial prospecting

and working of considerable mineral deposits, notably La Libertad district, which has some large well-defined ledges bearing gold and silver, and the Pis Pis and Concepcion districts, where gold was mined for many years in limited quantities.

Section 4: The Caribbean littoral, extending from 40 to 50 miles inland, is largely swamp land. Bananas and coconuts are the only products of this section. The principal rivers would be navigable by large vessels but for the sand bars at their mouths, and hence navigation is limited to small boats.

Sections 1 and 2 have their outlet on the Pacific coast, and sections 3 and 4 have their outlet on the Caribbean coast. The transportation difficulties separating the east and west coast regions are such that they have little in common except that they are under one government. An attempt was made about 2 years ago to remedy this nonintercourse evil somewhat by the construction of the so-called "Carretera Atlantica" (Highway to the Atlantic) from Tipitapa, but this project was abandoned for lack of finances following the earthquake of 1931.

Coffee.—There are three principal regions of coffee cultivation, all on or having their outlet on the west coast. These are (1) The Sierra district, comprising the range of hills south and west of the city and lake of Managua; (2) the Pueblo district, geographically a continuation of the Sierra district and differing principally in that the steep Managua hills become tablelands in the department of Carazo and part of Masaya, allowing better cultivation and consequent better production both as to quantity and quality; and (3) the Matagalpa district, 90 to 100 miles from the coast, lying largely on the upper part of the Caribbean watershed. The Matagalpa district surrounds the town of Matagalpa, extends northward into Jinotega, including those small portions of Esteli and Nueva Segovia devoted to coffee, and produces a better bean at higher altitudes than the other districts, although having a somewhat reduced production per tree.

Normally, the average production of the Sierra district, including a small quota from Chontales, is estimated at 33 percent of the coffee total, or 105,700 quintals a year from 17,620,000 trees on 34,000 acres, representing a production of 0.6 pound per tree. That of the Pueblo district, including a small quota from Granada, is estimated at 44 percent of the total, or 140,700 quintals from 17,600,000 trees on 41,700 acres, or 0.8 pound per tree. That of the Matagalpa district is estimated at 21 percent of the total, or 67,200 quintals from 13,500,000 trees on 29,500 acres, or 0.5 pound per tree. The remaining 2 percent comes from scattered plantings in the departments of Leon, Chinandega, and Rivas.³

³ This was as of 1927. Since then there has been considerable new development in coffee planting in the Matagalpa district, principally in the variety of coffee known as "Maragojipe", a supersize bean which commands a fancy price in the German market. The 1931 estimate of coffee acreage was about 120,000.

In the decade 1921-30 the value of coffee exported from Nicaragua aggregated over \$50,000,000, exports of all commodities for that period reaching \$105,000,000. Exports for the 1926-30 period averaged 32,000,000 pounds annually. Assuming a per capita consumption of 10 pounds annually, or 6,400,000 pounds, the total production would approach 40,000,000 pounds (400,000 quintals). The best results come from a planting of 400 trees to the acre. The quality of Nicaraguan coffee is regarded as somewhat inferior to that of Costa Rica and Guatemala, although improved processing would yield a much better grade. Therefore, the Nicaraguan product is more acutely affected by Brazilian policy and production than are the quality coffees of other Central American countries. Nicaraguan coffee is further handicapped by inadequate transportation facilities. It costs \$15 to \$18 per ton to truck coffee from Matagalpa to railhead at Managua, a distance of 78 miles over a highway which is being permitted to deteriorate rapidly. Prior to the construction of this highway the cost ran as high as \$40 a ton by bull cart in the height of the harvesting season. It is believed that the coffee potentialities of Nicaragua, if fully developed, would be at least 1,250,000 quintals annually, the potential areas being in the northern Provinces and eastward. A line drawn due north from Comolapa through the department of Jinotega would bisect an area, now inaccessible, of potentially the richest coffee land in the Republic.

Bananas.—This fruit is grown throughout Nicaragua, but only on the alluvial lands bordering the east coast rivers has its cultivation reached export proportions. It has been the principal east coast industry since the beginning of the present century, now accounting for about 17 percent of the country's exports. The greater portion of the bananas exported from Bluefields is grown near the Rios Grande and Escondido. New banana lands have been found along the Rio Punta Gorda, from which the fruit is barged to Bluefields. Bananas are also produced in small quantities near San Juan del Norte, Rio Indio, Rio Corn, Prinzapolka, and Corn Island, and shipped to Bluefields for exportation. The industry is controlled by two American companies, which also purchase from individual growers. It gives employment to as many laborers as all other east coast industries combined. Average annual exports for the 5-year period 1926-30 were 3,128,000 bunches, valued at \$1,763,000. At present the volume of banana shipments is about equally divided between El Bluff and Puerto Cabezas.

Cacao.—This product has long been produced in Nicaragua and at one time it was the principal item in the foreign trade of the country with Mexico and Peru. The largest producing district appears to have been the Department of Rivas. Estimates of production during recent times are lacking. Exports during the past 3 years have averaged about

575,000 kilos annually, valued at \$46,000. It is an important food item of the people. During recent years production costs have been too high for it to compete in foreign markets with South American and African cacao.

Sugar.—The peak year in sugar export was 1921 when over 12,000,000 kilos, or about 26,400,000 pounds, were exported, valued at \$1,309,000. Practically all of it went to the United States. West-coast Central American sugars are popular with west-coast United States fruit canners when the American tariff makes their purchase practicable. Annual average exports, 1926–30, were about 7,000,000 kilos, valued at \$488,000. It is unlikely that sugar will be an increasingly important factor in Nicaraguan foreign commerce for many years to come, unless world market conditions change materially. The principal plant, that of the Nicaragua Sugar Estates at Chichigalpa, on the railroad between Chinandega and Leon, has a capacity of 250,000 to 300,000 quintals; the remaining plants producing probably about 150,000 quintals more. As in other Latin American countries, the inhabitants consume an inordinate amount of pan sugar (panela). Nicaraguan sugar land produces as high as 100 tons of cane to the acre, but much of the land has been overworked and undernourished.

Cotton.—From 1909 to 1925 cotton exportation averaged about 185,000 pounds annually. About 5,000 acres were planted in the Departments of Leon and Chinandega in 1924. Little is grown today; pests and low prices having discouraged the planters.

Tobacco.—This product is grown on the west coast only, principally in the Masaya district, and increasing attention is being paid to its culture. Former President Moncada has devoted one of his numerous fincas to tobacco with fairly satisfactory results. South of Rivas and near the Rio Sapoa is to be found some good tobacco land. Planting and sale are controlled by the Government. It was estimated in 1926 that about 1,000 acres were devoted to tobacco production and probably 1,500 acres are so planted today in addition to some unregistered planting. While the grade is excellent and the industry could be extended, Government restrictions have handicapped tobacco production and confined it to home consumption. Sales from 1921 to 1925 approximated 700,000 pounds, upon which the Government received an average revenue of 35 cents a pound.

Coconuts.—This is chiefly an east coast industry, whence one to two million coconuts are exported annually. Exports for 1929 and 1930 amounted to 1,797,000 and 2,197,000 nuts, respectively, valued at \$38,000 and \$42,000. Little if any copra is exported, due chiefly to Philippine competition.

Rice.—This is one of the chief articles of diet of the Nicaraguans and the country should be self-supporting in this product, instead of spending an average of

\$100,000 annually abroad for rice, chiefly because of the difficulty of transportation from interior parts. It is grown in certain sections on the west coast, particularly in the Masaya district. A few years ago rice production had reached the point where imports of this commodity fell from 2,000,000 to 1,000,000 pounds. In 1928 Nicaragua imported 2,000,000 and in 1929 about 2,500,000 pounds, and it is evident that domestic production has been falling off probably due to internal disturbances. Rice acreage has been estimated at 1,000, and here again former President Moncada has been taking the lead in production. In his opinion better highway facilities would greatly increase rice production and enable Nicaragua not only to supply its own needs but have a surplus for export. The inter-American highway would open up a considerable area utilizable for rice growing.

Corn.—This is the base food crop of the country, with probably 350,000 acres now devoted to its production, the production area having increased at the rate of 6,000 to 8,000 acres annually since the railroad was completed nearly 30 years ago. The most important producing areas are Leon, Chinandega, and the Masaya district, areas to be traversed by the inter-American highway, the two first-named having an estimated production of 300,000,000 pounds annually from an acreage of about 250,000, two crops being produced each year. Of the estimated corn acreage in the uplands of the Sententrion, Matagalpa and northward, and the Chontales regions—275,000—about 60 percent is devoted to kaffir corn and 40 percent to maize, the aggregate production of the two crops being 320,000,000 pounds. The total corn acreage of the country, maize and kaffir corn, is not far from 500,000 acres, or nearly 50 percent of the entire cultivated area of the republic. Corn is an important article of Nicaraguan export, and in 1933 a large quantity was shipped to Guatemala where there was a shortage for domestic consumption.⁴

Wheat.—The Sententrion region formerly produced wheat in sufficient quantity to supply its local needs and some for the west coast. Wheat growing was abandoned as the coffee industry developed. Flour imports from 1921 to 1930 ranged from \$305,000 to \$644,000 in value.

Beans.—Beans form another staple crop of the Nicaraguans, but the consumption is not more than 10 percent of that of corn. Between 30 and 40 thousand acres are planted to beans. The white variety, grown in the Departments of Leon and Chinandega, runs 880 pounds to the acre, total production about 10,000,000 pounds. The red variety, grown in the Matagalpa section, and the yellow, grown in the Masaya section, show a higher production per unit

⁴ By the time this corn had been freighted to Corinto, thence by vessel to Champerico, then by rail to points of distribution in Guatemala, it had more than doubled in value. If it could have been trucked over a highway, there would have been considerable saving in freight charges.

of land. It is estimated that 40,000,000 pounds are consumed annually by the 550,000 inhabitants of the west coast.

Plantains and garden vegetables are grown to some extent, the former being cultivated to the extent of about 20,000 acres.

Stock raising.—This was formerly a considerable industry, an estimated 805,000 head being raised annually prior to the disorders which began in 1926, distributed somewhat as follows:

TABLE 4.—*Annual livestock production prior to 1926*

Locality:	Number of head
Chontales.....	350, 000
Sententrion district:	
Matagalpa.....	45, 000
Esteli.....	60, 000
Jinotega.....	45, 000
Nueva Segovia.....	55, 000
Western district: Leon and Chinandega.....	100, 000
Eastern district:	
Rivas.....	50, 000
Granada.....	40, 000
Managua.....	40, 000
Carazo and Masaya.....	20, 000
Total.....	805, 000

The principal cattle section is the plains of Chontales, northeast of Lake Nicaragua. The Matagalpa, Leon, and Chinandega districts are largely devoted to dairying, formerly producing about 1,000,000 pounds of cheese a year. All of these sections would be benefited by the inter-American highway. There is a lack of scientific breeding. Cumberland estimated 300,000 head at the time his report was written and since then the cattle industry has dwindled still more. The present estimate is 250,000 head, with an average value as low as \$7 a head. Relatively large exports of cattle have been made to Costa Rica and Honduras during recent years, those to the former bringing a better price as the grazing lands around Rivas, where succulent pasturage abounds, are used for a period of fattening before the cattle are driven across the border. Exports to Costa Rica totaled \$683,000 in value in 1929 and \$227,000 in 1930. There seems to be unanimous belief in Nicaragua that the inter-American highway, in addition to opening up some rich territory, would be a great impetus to stock raising, the total capacity of the country being estimated at 3,000,000 head. In 1929 Nicaragua employed the services of an American expert (Prof. Jewell Knight) to advise and report on the potentialities of stock raising. Professor Knight's report indicated great possibilities in this field provided more care and attention were given to the industry.

Hog raising is not a developed industry, being chiefly in the hands of small farmers. In 1926 the Matagalpa district counted between 8,000 and 10,000 hogs and native stock had been improved by importations of breeds from other countries. At that time hogs were

slaughtered in Leon at the rate of 1,000 a month. They can be economically raised on bananas and sugarcane and finished on corn. Under present methods peripatetic pigs yield a poor grade of lard and there is no market for the product except in Central America. Lard imports totaled nearly 405,000 kilos in 1928 and 385,000 kilos in 1929.

In 1926, 15,000 horses and mules were reported in the Matagalpa district, the latter predominating. Nothing like that number exists today; indeed, the Guardia Nacional has at times experienced difficulty in securing mounts. Oxen are the chief draft animals, horses and mules being used chiefly for pack and saddle in the rainy season.

Owing to the heat and moisture it is practically impossible to raise sheep. While nearly every family possessing a home has chickens, the poultry industry as such does not exist.

Cumberland writes of the general agricultural conditions as follows:

Expansion in agriculture, and stock raising is dependent upon improved means of transportation, better technical methods, and to some extent upon an enlarged population. Assuming these to be supplied, products which seem to offer the most favorable prospects are coffee in the north central and southwestern regions, bananas and possibly coconuts along the east coast, sugar, cereals, and cotton in the western districts, and livestock in the east central area.

So far as exports are concerned, no other crops are of great importance. From the point of view of domestic consumption, however, corn, rice, beans, and livestock are of almost equal significance with the so-called "money crops."

Both absolutely and in comparison with the population of the Republic the area utilized for economic purposes is small indeed. When it is considered that agriculture is the principal source of wealth and income and that probably less instead of more than 2.5 acres per capita are devoted to agriculture and stock raising, more evidence is offered of the backwardness of the country and the unsatisfactory standard of living. When to restricted per capita area under cultivation is added the fact that this acreage is cultivated in a primitive manner and that the yields are correspondingly low, there can be no surprise at the limited purchasing power which the population possesses.

It is estimated that of total expenditure for food of \$12,500,000 per annum \$10,500,000 is employed for commodities produced locally and \$2,000,000 for imported foods, beverages, and tobacco. * * * If these estimates are correct it follows that monthly expenditures for food for each person productively employed amount to \$8.33 distributed as follows: Domestic food \$7 per month and \$84 a year; imported food \$1.33 a month and \$16 a year.

Forest resources.—One estimate of standing timber gives 10,000,000 acres, equal to one-half the cultivable area of the country. It does not follow that this is all merchantable. There is also some available on the 10,000,000 acres of waste land. During the 7-year period, 1923-29, annual exports of lumber averaged 22,000,000 board feet, valued at \$1,500,000. But in 1930 there was a bad slump in the business, when but 11,200,000 feet were exported, valued at \$535,000. About half this export was of pine, considerable going

to Panama. There is a great deal of pine along the Rio Coco, not of the best quality. A belt of pine timber covers all the northern part of the department of Jinotega and all of the Cabo Gracias, extending in the latter section to the Caribbean coast. An American company has been operating for several years in the Puerto Cabezas region, exploiting some 75,000 acres of this pine. Production in 1928 was estimated at 16,000,000 board feet, 15,000,000 in 1929, and 13,000,000 in 1930. Exports for 1928 were valued at \$407,000.

Mahogany has long been the chief wood export, the stands bordering the banks and tributaries of the Rios Escondido, San Juan, Grande, Prinzapolka, and Coco on the east coast having been exploited for over a century. Production is almost entirely for export. Mahogany exports for the 1923-27 period ranged between \$1,000,000 and \$1,500,000 in value, but dropped to \$732,000 in 1928, to \$630,000 in 1929, and to \$59,000 in 1930.

Next to mahogany, cedar has been the chief export. In the vicinity of Cosaguina Point, not far from the proposed line of the inter-American highway, enormous stands of cedar are reported. Some guayacan (the *lignum vitae* of commerce, but not true *lignum vitae*) is shipped from the north over the Managua-Matagalpa highway by truck and loaded aboard at Corinto. "As yet", says Cumberland, "there are ample timber resources in Nicaragua, although timber most available to transportation has already been harvested." Logs are transported by ox teams and tractors to the numerous watercourses and brought to tidewater in flood time. Foreigners conduct the principal lumber activities.

From 1890 to 1917 crude rubber was shipped from the east coast in the amount of 600,000 pounds annually, valued at \$250,000. Rubber exports have practically ceased, due to East Indian competition. A preliminary survey has indicated that 60,000 acres of land are available for rubber production and another estimate shows that 750,000 pounds annually could be obtained from the banks of the east-coast rivers. But production is unprofitable without a safe margin in the United States over 45 cents a pound.

Fibers give promise of some commercial possibilities, if cheap transportation in the west-coast highlands can be secured. Henequen does well and enough is produced for the local supply of hammocks and articles of similar manufacture. A still finer fiber is locally known as "pita", similar to henequen. This fiber is said to be so fine that it will spin, but the handicap to an extension of its cultivation lies in the fact that it has to be extracted from the leaf by hand, a laborious process.⁵

⁵ The perfection of a decorticator would give a large industry to all the countries of Central America. Large concessions for the growing of "pita" are available in these countries. Repeated inquiries have been made as to a source of supply by American manufacturers, but without a machine to extract the fiber, the further development of growing areas seems useless.

MINING

Gold mining is the oldest industry in Nicaragua, having been pursued since colonial days. From 1909 to 1924 gold exports averaged around \$1,000,000 annually. Silver exports, formerly appreciable, have become insignificant. Other minerals exist, but probably not in merchantable quantities. In 1910, 60 mines were in operation, but until recently only 1 was active—the Jabali mine in Chontales, operated by the Cia. Minera del Jabali. Other districts which have in the past produced, or which are reported to have mineral resources, are Matagalpa, Esteli, and Nueva Segovia. On the eastern slope there are several known mineral districts: The Pis Pis, the Concepcion, and the Cuicuina districts in the Province of Prinzapolka; the Wawa district in the Province of Cabo Gracias a Dios; the Chine district, in the Province of Rio Grande; and the Sequia district in the Province of that name. Of these, the Pis Pis and Concepcion districts, located at the headwaters of the Rios Banbana and Prinzapolka, have been the most important producers. The Atlantic coast workings have been chiefly of the placer type. In the past banditry has worked havoc in the gold-mining industry. Cumberland notes that—

* * * Inadequate transportation is probably the chief reason for failure of many mining operations. For example, freight rates from New York to Corinto may be considered as \$14 a ton.

This was in 1928—they are \$15 now on typical mining supplies.

Yet for the relatively short distance from Corinto to the mining region of the north central area freight charges are \$66 per ton. It is estimated that reducing transportation expenses by one-half would result in lowering mining costs by \$1 per ton, and in several instances this would constitute the difference between operating at a profit as compared with the present loss.

There have been rumors of petroleum deposits in Nicaragua from time to time, but recent investigators representing a large American company, after looking over the field, decided that it was not worth exploiting.

MANUFACTURING

With the exception of the distilling, brewing, and sugar industries, all of which are on the west coast, manufacturing in the larger sense does not exist in Nicaragua. Shoes and leather goods of fair quality are hand made by a number of small concerns; also soap, candles, and a number of minor products are produced for local consumption. In general it may be said that industrially Nicaragua has not progressed beyond the handicraft stage, and with the possible exception of remarkably fine hammocks made in Masaya, even the handicrafts present nothing notable.

WATER POWER

The only estimate known to have been made on available water power in Nicaragua is that of the

United States Geological Survey, 1921, which gives 800,000 potential horsepower.

TRANSPORTATION AND COMMUNICATION

Ocean transport.—About 75 percent of Nicaragua's imports is shipped through the port of Corinto, while 65 percent of its exports goes out through that port. Table 5 shows imports and exports by port and value during 1929 and 1932, tonnage figures not being available.

TABLE 5.—*Foreign trade by principal ports*

IMPORTS		
Port	1929	1932
El Tempisque.....	\$1,944	\$888
San Juan del Sur.....	236,453	103,340
Cabo Gracias.....	112,060	1,309
San Juan del Norte.....	337	147
Puerto Cabezas.....	950,375	195,510
El Bluff ¹	1,643,669	424,327
Corinto.....	8,852,602	2,754,357
Total.....	11,797,440	3,479,878
EXPORTS		
El Tempisque.....	\$92,458	\$22,743
San Juan del Sur.....	100,695	17,250
Cabo Gracias.....	37,632	12,545
San Juan del Norte.....		
Puerto Cabezas.....	1,192,986	1,194,849
El Bluff ¹	2,433,275	1,391,539
Corinto.....	7,015,480	1,902,671
Total.....	10,872,526	4,541,597

¹ For Bluefields.

The number of steam vessels engaged in foreign trade entered at Nicaraguan ports in 1929 was 593, with a capacity of 894,622 net registered tons. The same number of vessels cleared 901,463 tons.

There is no recorded coastwise trade on the Pacific coast of Nicaragua, deliveries to the west interior being effected by rail and cart. The customs report for 1929 gives entries to and clearances from the Atlantic coast ports of San Juan del Norte, El Bluff, Cabo Gracias, and Puerto Cabezas aggregating 96,448 tons, of which 95 percent consisted of gasoline launches and small sailing vessels. Sixty-four percent of this coastwise traffic was in and out of El Bluff.

Due to disturbed conditions at the time the present study was made, no opportunity was afforded to note freight costs by bull cart and truck in the northern section. In the southern section it was ascertained that the cost of freighting by bull cart from San Juan del Sur to Rivas, a distance of 20 miles, was \$3 a ton in the dry and \$4 in the rainy season. From San Juan del Sur to San Jorge, 22 miles, the charges were about \$3.60 and \$4.80 a ton, the two seasons respectively. This is for 4 oxen, 2 men, and a cart, all day, returning the next day empty. The freight rate, San Juan to Granada, by bull cart, railway, and lake steamer, is \$7 a ton. A 150-pound sack of flour delivered in Granada by way of Corinto and the railroad pays \$1.10. The same by way of San Juan, cart, rail, and

steamer to Granada pays 90 cents. These two prices include transfer from wharf and delivery inside the bodega in Granada. Lime made in Nandaime sells in Granada for \$1.20 per fanega (about 200 pounds). Freight on the same, Nandaime to Granada, dry season, is \$2.50 a ton; wet season, \$5 a ton.

Highways.—There are 897 miles of highway in Nicaragua, classified by types as follows: Graded and drained, 381 miles; earth, 513 miles; and asphalt, 3 miles. The earth roads are passable only in the dry season. All roads are in the western part of the country, and transportation on the east coast is restricted to mule-back on land and small boats on rivers. Practically all the highways are deficient in roadbed and drainage. The American consul at Corinto states:

It is generally realized that the economic development of Nicaragua depends to a large extent upon the construction of an adequate highway system.

Railways.—There are 146 miles of railway line (the Pacific Railroad of Nicaragua) belonging to the Government and connecting the port of Corinto with Leon, Managua, Granada, and the small towns in the coffee region. This railroad has been an important factor in the country's transportation development. It has also served as security for loans, and its control has been the issue of certain political differences. Its net income for the fiscal year ended June 30, 1932, was \$219,473. The San Jorge-San Juan del Sur line was officially opened December 18, 1932, and the Leon-El Sauce Railroad was opened December 30 of the same year.

There are some 100 miles, or less, of privately owned standard and narrow-gage railroads operated by sugar, banana, and lumber interests.

Direct rail connection between the east and west coasts has been discussed for the past 35 years and many surveys made, but finances have not been available for actual development.

Waterways.—A project to open the Rio San Juan to navigation was included in the survey by American engineers for a canal, river, and lake system of waterways across Nicaragua from the Atlantic Ocean to the Pacific Ocean. This river, for centuries Nicaragua's outlet to the world, is now closed to navigation except for small craft, because of silt and sand drifted across its mouth. This was the route controlled by Commodore Cornelius Vanderbilt, by which California was reached in the middle of the 19th century.

It was estimated that \$5,000,000 would be sufficient to construct an ocean terminal at the river's mouth, dredge the channel, and construct two small locks at the rapids, thus opening up the 200-mile water route to Lake Nicaragua ports and the thickly settled region around the capital.

Airways.—Of the several landing fields in Nicaragua which are maintained in fair shape the one at Managua,

under the management of Pan American Airways for its service through the country, is probably the outstanding airport. It has been given a standard second-class rating.

Service to various interior towns of Nicaragua and an international service to Tegucigalpa are provided by a Honduran company under a year's contract. Arrangements were under way in the spring of 1933 for the establishment of services for the transportation of "individuals, baggage, and correspondence" within the country. These services were to be undertaken by an individual, an American citizen. In addition, Pan American Airways stops twice a week on south and northbound trips on its service between Miami and Panama.

Automobile statistics.—Automobile registrations in Nicaragua on January 1, 1933, totaled 1,390, divided as follows: Passenger cars, 1,051; busses, 31; trucks, 201; motorcycles, 107. These motor vehicles are largely owned and driven in the region of the capital, where are found most of the improved roads of the country.

HIGHWAY ECONOMICS

Existing bus service.—According to the American vice consul at Managua, there are no registered bus lines operating a regular service between any two cities in western Nicaragua. There are several remodeled privately owned trucks which carry passengers between the Departments of Granada, Carazo, and Managua when roads permit. Various small firms operate a total of 16 autobusses in Managua, all charging a fare of 5 cents.

Future highway development.—The following are suggested as practicable locations for future road construction, connecting with the proposed inter-American highway, and over which bus and truck operations could eventually be developed:

1. Rivas to San Jorge on Lake Nicaragua and to San Juan del Sur on the Pacific Ocean.
2. Nandaime to Jinotepe and Casa Colorada, and to San Rafael del Sur on the Pacific Ocean.
3. Granada to Juigalpa and Comalapa and contiguous sections of the Department of Chontales.
4. Masaya to Masatepe and San Marcos.
5. Managua to Tipitapa, Tuestepe, Boaco, and Juigalpa on toward the Atlantic Ocean at Rama on the Rio Escondido. (This was the Atlantic highway, construction on which was brought to a standstill by the Managua earthquake of 1931.)
6. Managua to Matagalpa. (Restoration of the road is necessary. It has long been used for trucking and travel into the coffee district.)
7. Leon to the Pacific Ocean.
8. Leon to El Jacaral, thence to Matagalpa and Jinotepe.

9. Leon to El Sauce to Esteli to Nueva Segovia. (Part of this line is suggested as an alternate for the inter-American highway.)

Tourist and other private traffic.—No serious efforts have been made to develop tourist traffic in Nicaragua, although the lake and mountain scenery is impressive and the hunting is excellent. The most practicable means of reaching interesting parts of the interior is by airplane or highway. The inter-American highway, once constructed, will furnish the necessary beginning of more extended road building planned to open to the traveling public the areas east of the lakes.

Government bureau of highways.—The national Government, through the Ministry of Interior and Public Works and the board of directors of the Pacific Railway, administers the highways. Revenues are derived from profits of the Pacific Railway, taxes from the export of bananas and coffee, vehicle registrations, and general revenues. Figures are lacking as to the amounts realized. Lack of funds during the past 3 years has resulted in a general curtailment of road work. Little or no construction was undertaken during the current year (1933). In 1929 about \$300,000 was expended in road construction; in 1931, about \$80,000. The expenditures in 1932 were limited to repairs. Nicaragua undertook a large highway project in 1930-31 when work on the Atlantic highway was started. It made good progress, up to the time of the Managua earthquake, a catastrophe that severely crippled the Government and necessitated a great deal of relief work. At that time work on the Atlantic highway ceased and the road funds were diverted to relief.

It will be noted from a glance at the table on national revenues that there is a small amount derived from highway and public roads imposts.

A project to administer a gasoline monopoly law was found to be impracticable. A gasoline tank of large capacity was erected at Corinto and the tank was sold to an American oil company and is now being used for bonded storage.

Asphalt and cement for road purposes are imported, the latter principally from Europe, but these imports have practically ceased for the present.

PUBLIC LANDS

Attempts to ascertain the amount of public lands have been fraught with difficulties. The Government has no catastro (census of real property) whatever. Dr. Aguado, former vice president of the Republic, who is well informed on the subject, estimated 15,000,000 acres, or half the entire land area which, on the basis of the Cumberland estimate for the entire country, would mean about 10,000,000 cultivable acres. Dr. Aguado's estimate is endorsed

by Hon. Juan Paulino Rodriguez, civil engineer, graduate of the University of Berlin, who declares he has traversed by foot and mule practically every corner of Nicaragua making triangulation surveys, et cetera. Mr. Rodriguez is recognized as the best authority on the subject. According to him, to begin at the southern boundary of San Juan del Norte and run along the western boundaries of the departments of Siquia, Rio Grande, Prinzapolka, and Cabo Gracias a Dios would embrace the greatest area of public lands; for, with the exception of certain properties chiefly following the water courses thus traversed or inclosed, and which in some instances are 18 to 20 miles in width, and an isolated title here and there, this entire area belongs to the Government.

In Chontales, on both sides of the mountain chain beginning at La Libertad and extending to Raudal de Toro, are large public tracts; east of the mountain chain being wet the year round, west having a dry season. The western part of Jinotega is titled, the eastern half consists of public lands. There are some public lands in Esteli and large areas in Nueva Segovia. Chinandega has some in the north. Managua, Masaya, and Carazo have ejidos (lands held in common), but little if any public lands, and the same is true of Leon.

FOREIGN TRADE

Table 6 shows the foreign trade of Nicaragua for the period 1928-32.

TABLE 6.—*Foreign trade, 1928-32*¹

Year	Total imports	Total exports
1928.....	\$13,350,000	\$11,693,000
1929.....	11,797,000	10,873,000
1930.....	8,172,000	8,343,000
1931.....	6,015,000	6,575,000
1932.....	3,480,000	4,542,000
Total.....	42,814,000	42,026,000

¹ From report of Collector General of Customs.

For the period 1921-31 the favorable trade balance was over \$15,000,000. The marked decrease in exports for 1930 was due to falling prices and in 1931 to low prices and smaller volume resulting, in part, from drought.

In 1929-30 the coffee crop export averaged 11 cents a pound, compared with 21 cents in 1921, and for the succeeding two crops the prices were still lower. Coffee accounts for nearly one-half of Nicaragua's exports. The falling off in exports in 1927 was due to unsettled conditions following the revolution in 1926. The decrease in value of imports in 1930 was due to the lack of purchasing power caused by the low prices of the products of the country and in 1931 to the same cause and, in addition, to the earthquake loss in the capital. The trade balances against Nicaragua in 1927-29 were more apparent than real. The large expenditures made

locally by the United States marines during these years increased the buying power of Nicaragua 200 to 250 thousand cordobas (dollars) a month. The marine expenditures may be considered as an invisible balance.

Assuming a population of 640,000 and taking the average exports and imports for the last 5 years (\$8,563,000 and \$8,405,000, respectively) per capita exports were \$13.38 and imports \$13.13.

In 1929 the United States took 53 percent by value of Nicaragua's exports, including 29 percent of her principal crop—coffee. In 1925 our share was 65 percent, including 32 percent of her coffee. In 1931 we took 53 percent of her total exports, but, notwithstanding low coffee prices that year, we took 19 percent of this product, valued at \$615,940. France has been Nicaragua's best customer for coffee.

In 1931 the United States supplied 61 percent of Nicaragua's imports. In 1925 we furnished 70 percent. In 1930 our share was 61 percent. Great Britain's share had remained fairly constant at 10 to 12 percent, although it dropped to 9 percent in 1931, while Germany's share has risen from 2 percent in 1921 to 9 percent in 1931.

Principal commodities exported and imported, with the principal countries of destination and origin indicated for 1929, are shown in tables 7 and 8.

TABLE 7.—*Exports of principal commodities*

Year	Bananas	Coffee	Sugar	Wood	Gold
1921.....	\$1,405,000	\$2,352,000	\$1,309,000	\$901,000	\$990,000
1929:					
United States....	1,985,000	1,768,000	185,000	874,000	434,000
France.....		868,000		1,000	
Germany.....		1,249,000		11,000	
Netherlands.....		871,000			
United Kingdom.....		399,000			
1930.....	2,239,000	3,792,000	366,000	535,000	424,000
1931.....	1,981,000	3,391,000	70,000	159,000	412,000

TABLE 8.—*Imports of principal commodities*

Year	Wheat flour	Cotton manufactures	Gasoline and kerosene	Iron and steel	Machinery
1921.....	\$313,000	\$1,118,000	\$387,000	\$307,000	\$1,052,000
1929:					
United States....	487,000	1,272,000	143,000	540,000	2,890,000
Peru.....			284,000		
Germany.....		63,000		136,000	227,000
United Kingdom.....		579,000		58,000	55,000
1930.....	388,000	1,298,000	346,000	578,000	817,000
1931.....	316,000	1,163,000	284,000	469,000	479,000

FINANCE

Nicaragua imposes a capital tax of one-half of 1 percent on appraised value on properties exceeding \$3,000 in value. With an average per capita wealth of but \$140 this property exemption seems high. There is general belief that appraisals are arbitrary. In 1921 this tax yielded \$184,000 compared with \$121,000 in 1929, \$127,000 in 1930, and \$97,000 in 1931.

Internal-revenue taxes approximating \$1,500,000 were collected in 1930 at a cost of nearly 12 cents on

the dollar. It has been estimated that no less than \$300,000 could be added to collections under this head with improved administration, which is now under way.

Receipts and expenditures.—Customs revenues for 1932 totaled \$1,681,365. The principal payments from this sum were as follows:

Interest and sinking fund on 1909 bonds.....	\$135, 971
Service of guaranteed customs bonds of 1918.....	92, 000
Government of Nicaragua.....	758, 365

The detailed statement of national revenues for 1932 is shown in table 9.

TABLE 9.—Government receipts in 1932

[Compiled from report of the High Commission]

	Amount
Customs.....	\$1, 075, 706
Various customs surcharges.....	490, 323
Consular fees.....	96, 365
Forestry tax.....	3, 954
Internal revenues.....	605, 409
School taxes.....	32, 923
Direct tax.....	72, 273
Property-transfer tax.....	2, 930
Corinto wharf.....	94, 316
Cathedral at Managua (coffee-export surcharge).....	17, 639
Banana export tax.....	52, 107
Tax for Communication Building.....	13, 049
Railroad tax.....	9, 964
National-bank tax.....	569
Impost on imported cigarettes.....	44, 545
Imposts on records and films.....	1, 047
Highway and public-roads impost.....	10, 439
Net income, Pacific Railroad.....	75, 008
Match monopoly.....	72, 009
Total.....	2, 770, 575

Details of the Government budget are lacking. For the fiscal year 1931–32 the allocations read as follows:

Legislative power.....	\$199, 839
Judicial power.....	175, 748
Executive power.....	1, 313, 897
National guard.....	1, 277, 082
Total.....	2, 966, 566

The 1931–32 budget was by resolution of the Assembly continued for 1932–33. An effort to economize in the 1933–34 budget failed in the assembly which, with some minor changes, continued the 1931–33 budget. The present budget is a saving of \$400,000 compared with that of 1930–31, and of nearly \$1,700,000 compared with 1929–30. National revenues declined 30 percent compared with the previous year, 44 percent compared with 1930, and 58 percent compared with 1929.

Public debt.—The collector general of customs and high commissioner for Nicaragua reports that payments for the service of the bonded debt, interest in full, and reduced amortization, were continued

throughout the year 1932. He gives the public debt as of February 28, 1933, as follows:

Sterling bonds of 1909 at \$4.8665.....	\$2, 373, 781
Guaranteed customs bonds of 1918.....	1, 117, 750
Total bonded debt.....	3, 491, 531
Estimated debts, claims awards unpaid, claims pending, subject to adjudication by claims commission.....	14, 370, 631
Total public debt.....	17, 862, 162

The \$14,370,631 comprises the following: (a) Claims awards unpaid, \$399,815; (b) claims pending on April 7, 1933, which may be settled on a basis of approximately \$2,000,000, \$10,970,816; and (c) the approximate deficit at the end of 1932 and the balance due on the \$1,500,000 loan made to the Government by the National Bank of Nicaragua in 1932, \$3,000,000; a total of \$14,370,631.

During the last 20 years, Nicaragua has made an excellent record in debt service and amortization. In 1930 it looked as if the customs bonds would be retired in 1938 or 1939, instead of 1953. Then came falling coffee prices and revenues and the earthquake of 1931. Nicaragua was forced to make a partial suspension of amortization payments in 1932, by agreement with her creditors. This released about \$335,000 for Government needs.

American investments in Nicaragua.—American direct investments in Nicaragua (according to Trade Information Bulletin No. 767 of the Bureau of Foreign and Domestic Commerce, U.S. Department of Commerce) totaled \$13,002,000 at the end of 1930, most of which was invested in fruit, coffee, and sugar plantations; mining, lumber, oil, engineering, and sanitation projects; and power, light, water, and ice companies.

Among the American holdings are the following:

Standard Fruit Co.
Cuyamel Fruit Co.
Constancia Consolidated Mining Co.
Tonopah Mining Co. of Nevada
Butters-Salvador Mines, Ltd.
Bonanza Mines Co.
Central American Exploration Co.
Public Utilities Consolidated Co.
Central American Power Corporation
Keilhauer & Hebard
San Albino Mines
Nicaraguan Mahogany Co.
Central American Saw Mills
All-America Cables, Inc.
Mengel & Co.
Tropical Radio Co.

In addition to the direct investments, some small holdings of the guaranteed customs bonds of 1918 are held in this country.

Other foreign investments in Nicaragua include British investments of approximately \$6,000,000, about half of which is invested in the sterling bonds

of 1929 and the customs bonds of 1918, the remainder in miscellaneous direct investments. About \$1,000,000 have been invested by the nationals of other foreign countries, but details regarding these investments are not available.

Sources of revenue possibly applicable to cost of proposed highway.—It would appear that the principal source of revenue which might be applied to the cost of that part of the inter-American highway passing through Nicaragua is to be found in the sale of public lands either fronting on, or not far from, the proposed route. Naturally the highway would enhance the value of these lands, and its influence would be felt as far as the Atlantic coast with the eventual completion of the Atlantic highway begun in 1930.

TECHNICAL SECTION

The proposed route.—The southern terminus of the Nicaraguan section of the inter-American highway is at the Costa Rica-Nicaragua boundary line, near Penas Blancas on the left bank of the Rio Sapoa. The northern terminus is near La Canoa on the Rio Negro, just below its confluence with the Rio Guasaule. The Rio Negro at this point is the boundary between Nicaragua and Honduras.

Connections are made at Sapoa with water craft plying Lake Nicaragua and the Rio San Juan; at Rivas with a national railroad connecting El Jorge on Lake Nicaragua with San Juan del Sur on the Pacific Ocean; at Granada with the National Railroad of Nicaragua and water traffic on Lake Nicaragua; at Masaya with the National Railroad; at Managua with the National Railroad, the Pan American Airways, and water traffic on Lake Managua; and at Leon and Chinandega with the National Railroad. At Leon there is a branch railroad line to El Sauce.

Junctions are made at Sapoa with trails leading into the surrounding territory; at Rivas with an earth road running from San Jorge on Lake Nicaragua to San Juan del Sur on the Pacific Ocean, and with trails and earth roads to the nearby villages and country; at Nandaime with a fair earth road to Jinotepe and beyond, and also with trails; at Granada with earth roads to Masaya and Tipitapa; at Masaya with the earth roads to Granada, Masatepe and Managua; at Managua with a road to Tipitapa and with earth roads to Jinotepe via Ticuantepe and thence to Managua via Casa Colorada; at Leon with an earth road toward Matagalpa and El Sauce; and at Chinandega with an earth road to Villa Nueva and trails into the surrounding country.

There were two general routes considered through Nicaragua. The first enters from Costa Rica at a point on the Rio San Juan, near the mouth of the Rio San Carlos. Thence it follows through the foothills and mountains to the east and northeast of Lake Nicaragua, passes between the lakes, and enters Managua

over the improved road from Tipitapa. The second enters from Costa Rica by way of the Rio Sapoa Valley, follows the south and southwest coast of Lake Nicaragua, and passes through the important towns of Rivas, Nandaime, Granada, and Masaya before reaching Managua.

The two routes are identical between Managua and the Honduran border, passing along the southwest shore of Lake Managua and through the towns of Nagarote, Leon, and Chinandega. Some of the terrain on either side of the Estero Real, between Chinandega and the Honduran border, is very low and flat and is subject to high water. In order to avoid passing over this section investigation should be made of a route from Leon north, crossing the Estero Real and Rio Villa Nueva higher upstream than the route described in this report. This investigation would have been made, but the field parties were advised by military authorities not to enter the territory on account of the unsettled conditions at the time.

The first route mentioned, entering near the mouth of the Rio San Carlos, was dropped from consideration when the difficulties present throughout the broken country to the northeast of Lake Nicaragua were added to those spoken of in the Costa Rican section of this report relative to the route from Naranjo to the Rio San Juan.

There were several alternates considered over short sections of the recommended route. Study was made of a line from La Cruz, Costa Rica, via San Juan del Sur to Rivas, Nicaragua, but it was not considered as feasible as the adopted route. Investigations were made of two lines from Nandaime to Managua, one via Jinotepe and Casa Colorada, and the other via Granada and Tipitapa. The former was abandoned, as it passes through rough terrain and does not serve the city of Granada, the latter because it is longer than the selected route and does not serve the population as well.

The recommended route passes through the most thickly settled and highly cultivated sections of the Republic and, although it lies along the narrow strip of land between the lakes and the Pacific Ocean, it is easily accessible to the interior districts by water and road. It passes through the departments of Rivas, Granada, Masaya, Managua, Leon, and Chinandega, the most thickly settled in the republic, and it is connected by water traffic on Lake Nicaragua with the important department of Chontales.

Control points.—The following control points are selected in order adequately to define the route:

1. A point on the Nicaragua-Costa Rica boundary line near Penas Blancas on the left bank of the Rio Sapoa.
2. Rivas, an important town lying between San Jorge on Lake Nicaragua and San Juan del Sur on the Pacific Ocean.

3. Nandaime, a small town situated at the junction of roads leading to Jinotepe and Granada.

4. Granada, one of the three largest cities.

5. Managua, the capital.

6. Leon, one of the three largest cities.

7. Chinandega, an important town a short distance by rail from the important seaport of Corinto.

8. A bridge site on the Rio Negro, the boundary between Nicaragua and Honduras. This point is near La Canoa and just below the mouth of the Rio Guasaule.

Running description.—Beginning on the west bank of the picturesque Rio Sapoa, at the Costa Rican boundary, and just below the confluence of the Rios Sapoa and de las Vueltas, the line passes through the Finca Penas Blancas and follows in a northerly direction to within a mile of the mouth of the Rio Sapoa. Thence it holds the shore line of Lake Nicaragua almost to the town of Rivas, an important city and capital of the department of that name.

There is a horseback trail between Penas Blancas and Rivas which passes through densely wooded and uninteresting territory and lies some distance from the lake. A line along the lake offers much of interest and many beautiful scenes. The lake alone is magnificent, but is unusually so when viewed from this section where the surface of its tranquil waters is broken by the majestic island volcanoes of Ometepe and Madera, and the whole vista has for its back ground the high mountains of the department of Chontales.

Leaving Rivas the line lies inland from the lake, but again approaches its shore at Granada. The section of country from Rivas to Nandaime is not particularly interesting, as a great deal of it is lowland and views are very limited. After passing Nandaime, the second town of importance in the department of Granada and the center of the lime-burning industry, the vistas begin to open up as the approach is made to the ridge that extends from the Continental Divide to Volcano Mombacho.

There is a road traversable in dry weather between Rivas and Granada, but in the lowlands near Rivas there are sections that are difficult even in dry weather on account of the deep ruts made in the wet season by ox carts.

The country immediately contiguous to Rivas is highly productive, which is evidenced by the numerous small villages in the vicinity.

The ascent from Granada to Masaya and the descent from the latter to Managua are through a picturesque and interesting section of the country. Extensive beds of lava, views of distant mountains, and crater lakes are among the attractions.

There is a road from Granada to Managua usable in the dry season. It passes through the picturesque and historic Indian villages of Nindirí, Niquinomo,

and Ticuantepe, which will prove of much interest to the traveling public.

Managua, the capital, is beautifully located on the southern shore of Lake Managua and from it there are splendid views of the celebrated volcanoes, Momotombo and Momotombito, lying across the water.

Many of the principal roads of the country focus at Managua, and it is the only city that has modern street paving. Approximately a third of the city is paved and it was this fact that greatly influenced the Government in retaining it as the capital following the earthquake of 1931, instead of moving the seat of government to a more agreeable climate, such as that enjoyed by the cities of Matagalpa and Jinotega.

There is a railroad from Managua via Leon and Chinandega to Corinto, the principal seaport of the country. Recently a revised line has been constructed for the section of this railroad between Managua and a point about 6 miles northwest of Los Brasiles. The old line between the above-mentioned points rose to above 800 feet, had grades approximating 3.5 percent, and was circuitous, especially near Lake Asososca. This section is to be or has been abandoned, and its use for the highway is contemplated. It passes partly around the crater in which is located Lake Asososca, and from its highest elevation may be had wonderful views of the surrounding country. This section and the one where the line follows the shore of Lake Managua will offer more of interest than any other between Managua and the Honduras line. The route, however, is seldom without attractions for many of the volcanoes mentioned heretofore are frequently in full view. From south of Masaya to a point near Leon the road will pass through the Sierra and Pueblo coffee district.

From the junction of the old and new railroad lines, approximately 6 miles northwest of Los Brasiles, the route skirts the shores of Lake Managua and then turns westwardly to Nagarote. From this place to Chinandega it follows parallel to the railroad over practically level terrain, passes through Leon which lies in a rich agricultural section, and is the distributing center for the Departments of Nueva Segovia, Esteli, Jinotega, and Matagalpa.

Chinandega is an important town of about 12,000 population, is the capital of the Department of that name and lies in a territory particularly adaptable to the cattle and sugar industries.

After passing from Chinandega around the foothills of Volcano Choncho, the route enters the lowlands bordering the Estero Real which are discussed elsewhere in this report.

There is an earth road from Managua to the Honduras line which could be traveled its entire distance during dry season if some provision were made for stream crossings and the roadway at places were

cleared of growth and debris. This road seems to be used only locally and in all probability has not been traveled as a through route on account of the fact that it parallels the railroad.

Excellent views of the volcanic range may be had at all times from the section of the route between Los Brasiles and the Honduras boundary.

Alinement.—The alinement between control points (1) and (2) can be held to almost any desired standard without excessive cost. The route here lies along the lower reaches of the Rio Sapoa and the shores of Lake Nicaragua, each of which offers terrain for an excellent location.

The line from control point (2) to control point (3) lies in territory offering varied topography. There are sections of llanos difficult to drain, where it will be advisable to adopt an alinement that will allow some undulations in the grade line. This is particularly true between Rivas and the Rio Ochomogo. From this point to Nandaime the terrain is rolling and no drainage difficulties will be encountered. Satisfactory alinement between control points (2) and (3) can be had without difficulty.

There is a range of mountains crossing the line between control points (3) and (4). This is a spur projecting from the Continental Divide toward the east and terminating with the Volcano Mombacho near the city of Granada. The line in passing through this ridge will necessarily have a normal amount of curvature for such terrain, but there will be no difficulty in maintaining the standard of alinement throughout the section between Nandaime and Granada.

The most difficult alinement problems are between control points (4) and (5). These occur along the mountain slopes on which the rise from Granada to Masaya is made, and again in the descent from Masaya to the plain near Managua. However, satisfactory alinement can be maintained throughout the section between the control points without excessive construction costs.

As mentioned before, it is contemplated that the abandoned railroad from Managua beyond Los Brasiles will be used for the highway. Recently a railroad, following more closely the lake shores, has been built between these points.

This section of terrain is the roughest between Managua, control point (5) and Leon, control point (6), but through here the alinement along the abandoned railroad is satisfactory. The only other places between the control points that will require much study for a proper location are at the river crossings, the most important of which is at Rio Leon.

Practically direct alinement can be had between control points (6) and (7), Leon and Chinandega, but it will be found advisable to embody sufficient curvature in the line in order to utilize terrain along which the drainage problems will be minimized.

No alinement difficulties present themselves between control points (7) and (8), Chinandega and the Honduras border, but after passing along the lower slopes of the Volcano Choncho much ingenuity of design will be necessary in order that drainage can be taken care of properly. As mentioned before it might be more feasible to go direct from Leon in a northerly direction to the Honduran border instead of passing by Chinandega.

Gradients.—There are no sections of the route where grades above the limiting standard will be necessary. The places where the heaviest grades will occur are the crossing of the mountain spur between Nandaime and Granada, the ascent to Masaya from Granada, the descent from Masaya to Managua, and the approach from the latter point to the summit near Lake Asesosca. It will be difficult to secure a percentage of grade sufficient to insure proper drainage in several sections, particularly between Rivas and Nandaime, and between Leon and the Honduras border. It is believed, however, that with a well-planned location such conditions can be properly taken care of by adjustments in alinement and grade.

There is a stretch near Estero Real between Chinandega and the Honduras border that is practically flat and, therefore, offers no other alternative for proper drainage than the elevation of the roadbed. This particular section has been referred to before and may be avoided by the alternate route suggested.

Mountains and valleys.—The route from where it enters Nicaragua to La Paz is on the Atlantic side of the Continental Divide. Near this point it crosses the Divide at a very low pass and continues on the Pacific side to the Honduras border.

There are three points where the line rises to elevations between 800 and 900 feet. These are between Nandaime and Granada, between Granada and Managua, and between Managua and Los Brasiles. Since the route is in close proximity to and almost paralleling the Continental Divide, there will be practically no valleys or ridges extending for considerable distances along which the location might follow.

Principal drainage.—The drainage is to the Atlantic Ocean through Lakes Nicaragua and Managua from the Costa Rica line to La Paz, and from here to the Honduras boundary it is to the Pacific Ocean.

The Ochomogo, Leon, and Estero Real are the largest streams crossed and they are comparatively small.

The Ostayo, Jabillo, Majaste, and Mayo are all short streams which are dry a great part of the year and present no difficulties to bridging. The Limon and Las Lajas have waterways about 75 feet wide and banks about 10 feet high. They both become dry very soon after the rainy season. The En Medio, Gil Gonzales, and Ochomogo are permanent streams, the latter having a waterway varying from 100 to 145 feet

All of the streams of any size in Nicaragua, with the exception of the Estero Real, can be approached and bridged without any particular difficulty. This is largely due to the fact that the drainage basins are small and the streams seldom overflow their banks.

Soil conditions.—The soil is very rich between Sapoa and Granada. Particularly is this true in the more elevated areas. The llanos are unfit for cultivation for the soil is a thick, sticky mud in the wet season and bakes very hard during the dry. The soil of the whole area is the result of decomposed volcanic lavas. The shore of Lake Nicaragua has an abundance of sand and gravel. There is a good grade of limestone near Nandaime, Chinandega, and at other points along the line, but it is doubtful if it could be obtained in sufficient quantities for surfacing. Usually the native stone is of volcanic origin and occurs in strata in the foothills near the line, as well as in cliffs along Lake Nicaragua, and some of this is excellent for road purposes.

The banks of the streams are usually of sandy clay. The beds are gravel and sand, over a volcanic rock.

From Granada to Managua the soil of the elevated areas is very productive, being of volcanic origin. In the lowlands near Granada and Managua it is a black sandy loam. There is an abundance of volcanic rock and lava throughout this section.

From Managua to Los Brasiles, where the line passes by Lake Asososca, the formation is weathered volcanic material. Some of this will make good material for surfacing. There is an excellent quarry a short distance from Managua, from which a large quantity of very good stone has been taken.

After leaving Los Brasiles the soil is sandy loam. There is a considerable quantity of field stone available in this section. Along the shore of Lake Managua and in the foothills the same stone is found in ledges.

The excessively low and flat area between Chinandega and the Honduras line seems to consist of a humus some 2 or 3 feet deep that absorbs a great deal of water during the rainy season and becomes impassable. During the dry season this material bakes very hard and cracks occur in it from 2 to 3 feet deep and several inches wide. Under the humus there appears to be a layer of gravel and beneath that a layer of sand. This insures proper stability for an embankment which would certainly be necessary for a highway through this low section.

Surfacing material would have to be brought in from the foothills of Volcano Choncho or from the hills near Las Mesas.

Along practically the whole line the soil becomes extremely dusty in dry weather. This is a characteristic of soils of volcanic origin and was particularly noticeable

between Leon and Chinandega where a fine sand and loam composes the upper strata.

Existing roads used.—There has been little road development in Nicaragua along the route of the highway other than the opening up of earth roads traversable only in the dry season. Some of these are on fairly good locations and parts of them can be utilized for short distances. This is so between Nandaime and Granada where a new grade has been made, and contiguous to Managua there are short stretches of paved road that can be used.

The Republic has undertaken in recent years the construction of a road from the capital to the Atlantic seaboard. The funds for this work were to come from the profits of the national railroads, but when Managua was destroyed by earthquake in 1931 they were diverted for reconstruction and rehabilitation work.

Materials.—For surfacing, the use of local materials is recommended. As is the case in several of the other countries, very few sections of the line will be found where the natural material of the roadway will itself be suitable. Consequently, surfacing materials will necessarily have to be transported from nearby sources.

Stone, loose and in ledges, will be found in the foothills bordering the line where it is in the lowlands, and also in the mountainous districts and along the lake shores adequate supply will be found.

Sand and gravel may be obtained from some of the larger river beds and along the lake shores.

As mentioned before, there is a quarry of excellent stone near Managua and limestone occurs near Nandaime and Chinandega.

Timber for construction purposes is available along the entire line, but is scarce between Managua and Chinandega.

On account of the fact that the line is reached at many places by the national railroads it seems advisable to construct the larger bridges of steel superstructure and concrete or stone substructure. The smaller structures can be made of either concrete or stone masonry although there are few places where suitable stone for the latter is available. Small culverts and pipe lines should be of sectional design in order to be easily transported.

Estimates of cost.—Tables 10, 11, and 12 itemize the estimated costs on the principal phases of the operations in Nicaragua.

The total length of the proposed inter-American highway in Nicaragua is 214 miles (344 kilometers).

All bridges are to have a 20-foot roadway.

One-half the cost of the bridge over the Rio Negro between Nicaragua and Honduras is carried in the estimates for all three types.

Estimates for type 1, table 10, contemplate an all-weather 28-foot graded section with a surfacing of local material 18 feet wide and 6 inches compacted thickness over the total 214 miles.

Estimates for type 2, table 11, contemplate the same as type 1 except for the addition of oil to the surface.

Estimates for type 3, table 12, contemplate a 32-foot graded section with a pavement of 8-inch-thick concrete, 20 feet wide.

Principal stream crossings in Nicaragua are shown in table 13 and the length of span is indicated for bridges not yet constructed.

TABLE 10.—*Estimates for type 1*

Item	Quantity	Unit	Unit cost	Amount
Cleaning and grubbing.....	214	Mile.....	\$350.00	\$74,900.00
Unclassified excavation.....	2,140,000	Cubic yards.....	1.00	2,140,000.00
Small drains.....	148,200	Lineal feet.....	10.00	1,482,000.00
Bridges.....	2,115	do.....	125.00	264,375.00
Surfacing.....	502,440	Cubic yards.....	2.50	1,256,100.00
Total.....				5,217,375.00
Add 12½ percent for engineering and contingency.				652,171.87
Total estimate.....				5,869,546.87

TABLE 11.—*Estimates for type 2*

Item	Quantity	Unit	Unit cost	Amount
Oil.....	1,129,920	Gallons.....	\$0.25	\$282,480.00
Type 1, all items.....				5,217,375.00
Total.....				5,499,855.00
Add 12½ percent for engineering and contingency.				687,481.87
Total estimate.....				6,187,336.87

TABLE 12.—*Estimates for type 3*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	214	Mile.....	\$350	\$74,900.00
Unclassified excavation.....	2,675,000	Cubic yards.....	1	2,675,000.00
Small drains.....	163,064	Lineal feet.....	10	1,630,064.00
Bridges.....	2,115	do.....	125	264,375.00
Surfacing.....	557,898	Cubic yards.....	15	8,368,470.00
Total.....				13,012,809.00
Add 10 percent for engineering and contingency.				1,301,280.90
Total estimate.....				14,314,089.90

TABLE 13.—*Principal stream crossings*

Name of stream	Length of bridge span	
	Feet	Meters
Quebrada Potrero.....	30	9
Quebrada En Medio.....	40	12
Quebrada La Pita.....	40	12
Quebrada La Espabel.....	40	12
Boca de Oja.....	30	9
Rio Pita.....	40	12
Rio Ostayo.....	40	12
Rio Jabillo.....	40	12
Rio Majasto.....	60	18
Rio Mayo.....	70	21
Rio Limon.....	200	61
Rio Virgen.....	40	12
Rio Las Lajas.....	120	37
Rio En Medio.....	80	24
Rio Gil Gonzales.....	100	30
Rio Aqueque.....	60	18
Quebrada de Las Lajas.....	40	12
Rio Ochomogo.....	200	61
Rio Cabeza.....	40	12
Rio Grande.....	80	24
Rio Boqueron.....	40	12
Rio Leon.....	100	30
Rio Telica.....	60	18
Rio Cosmapa.....	60	15
Rio Encantada.....	30	9
Rio Encantada (2).....	30	9
Rio Encantada (3).....	30	9
Estero Real.....	100	30
Rio Villa Nueva.....	60	18
One-half the length of bridge over the Rio Negro.....	225	69
Total.....	2,115	645



DEPARTAMENTO	CAPITAL	DEPARTAMENTO	CAPITAL
A CABO GRACIAS Á DIOS	CABO GRACIAS Á DIOS	J NUEVA SEGOVIA	OCOTÁL
B BLUEFIELDS	BLUEFIELDS	K ESTELÍ	ESTELÍ
C SIQUIA		L CHINANDEGA	CHINANDEGA
D SAN JUAN DEL NORTE	SAN JUAN DEL NORTE	M LEÓN	LEÓN
E CHONTALES	JUIGALPA	N MANAGUA	MANAGUA
F RIO GRANDE		O MASAYA	MASAYA
G PRINZAPOLCA		P CARAZO	JINOTEPE
H JINOTEGA	JINOTEGA	Q GRANADA	GRANADA
I MATAGALPA	MATAGALPA	R RIVAS	RIVAS

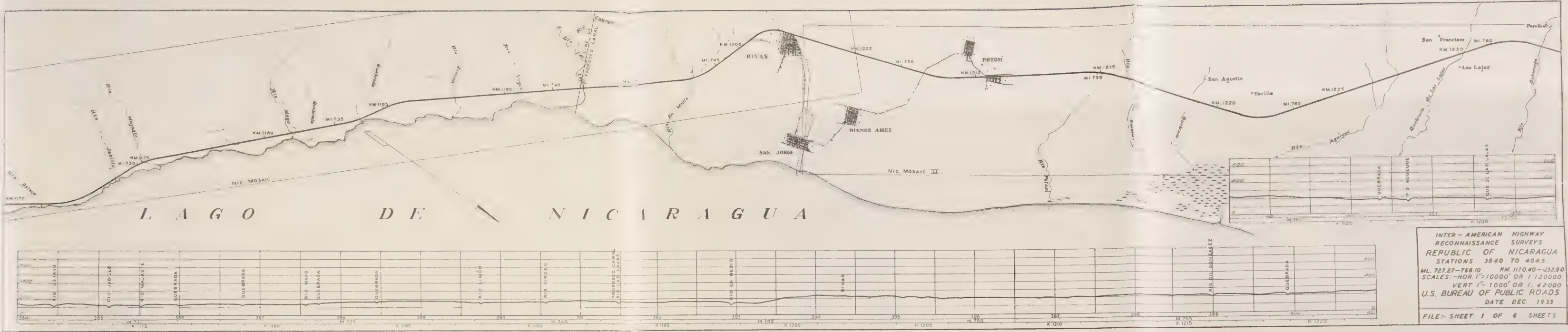


PLATE 29.

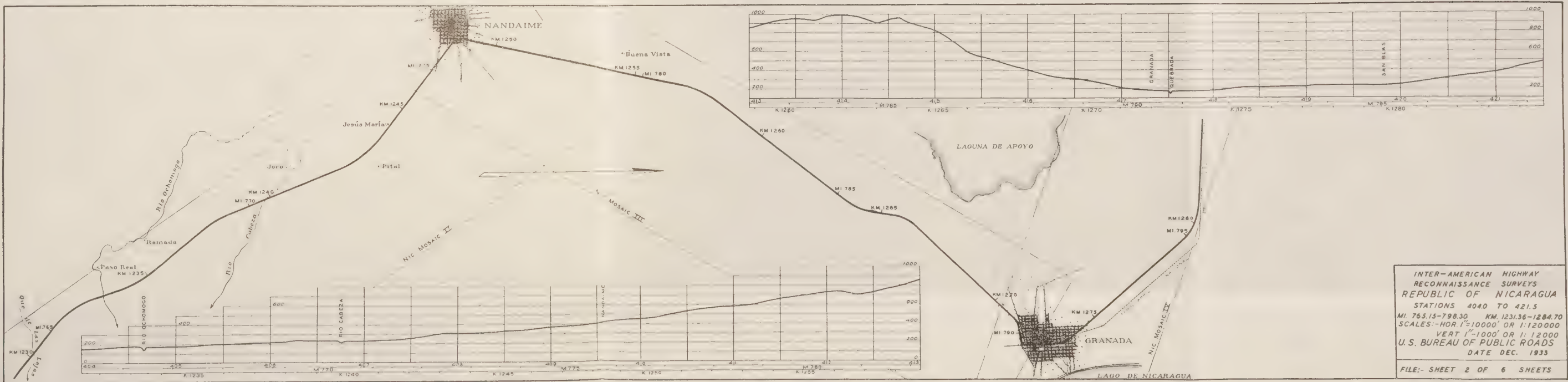


PLATE 30.

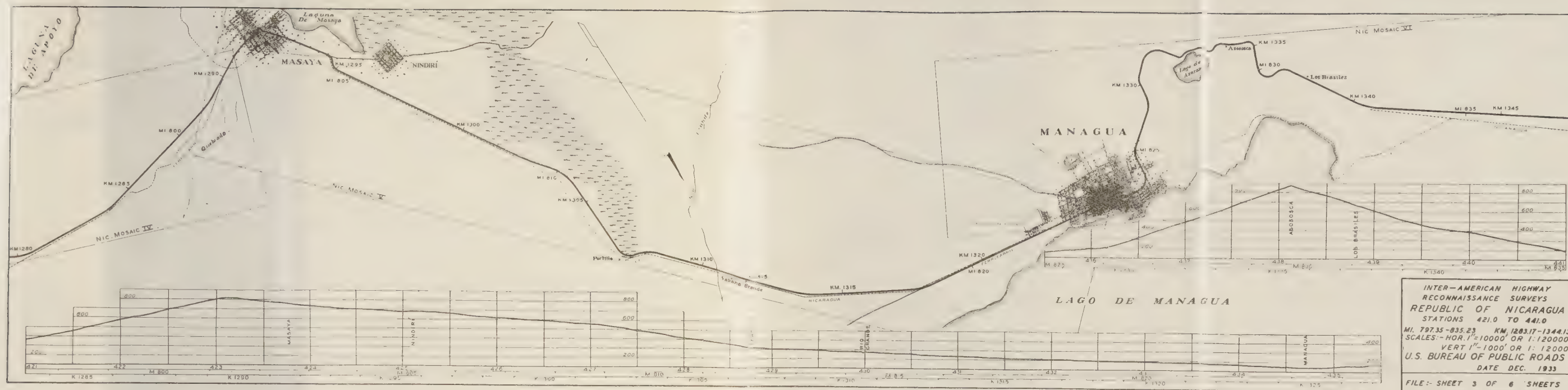


PLATE 31.

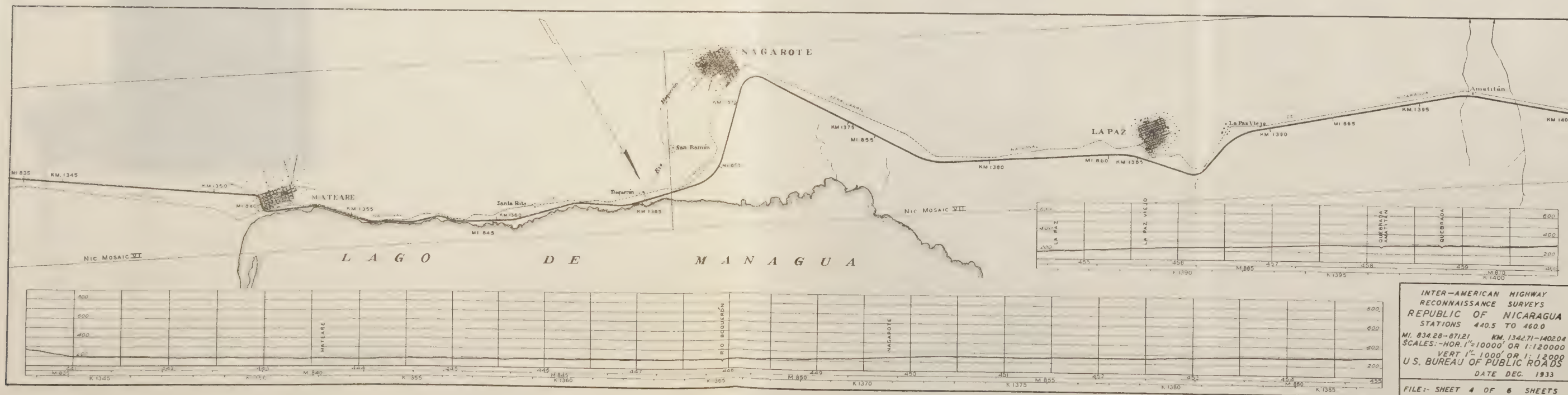


PLATE 32.

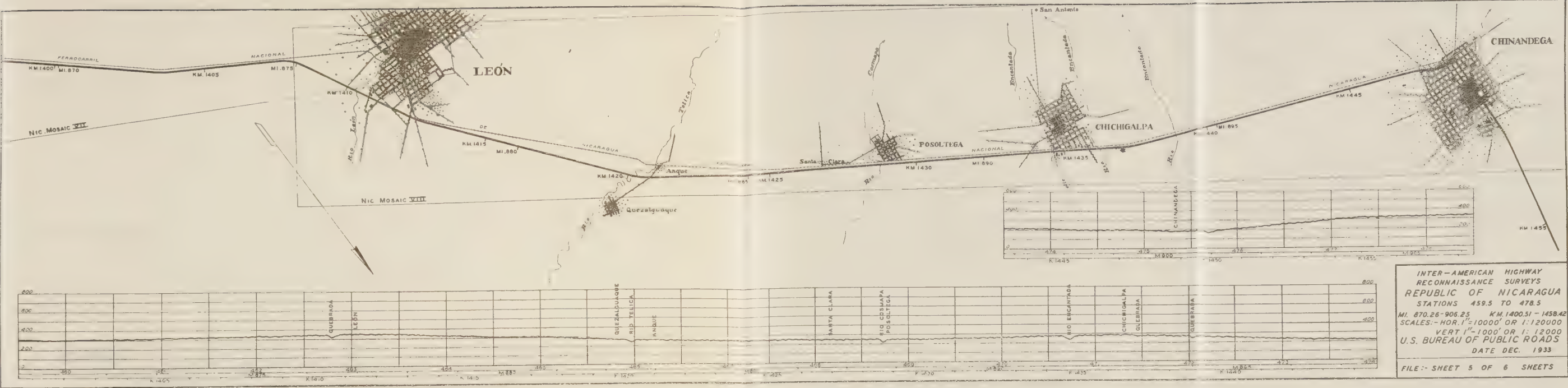


PLATE 33.

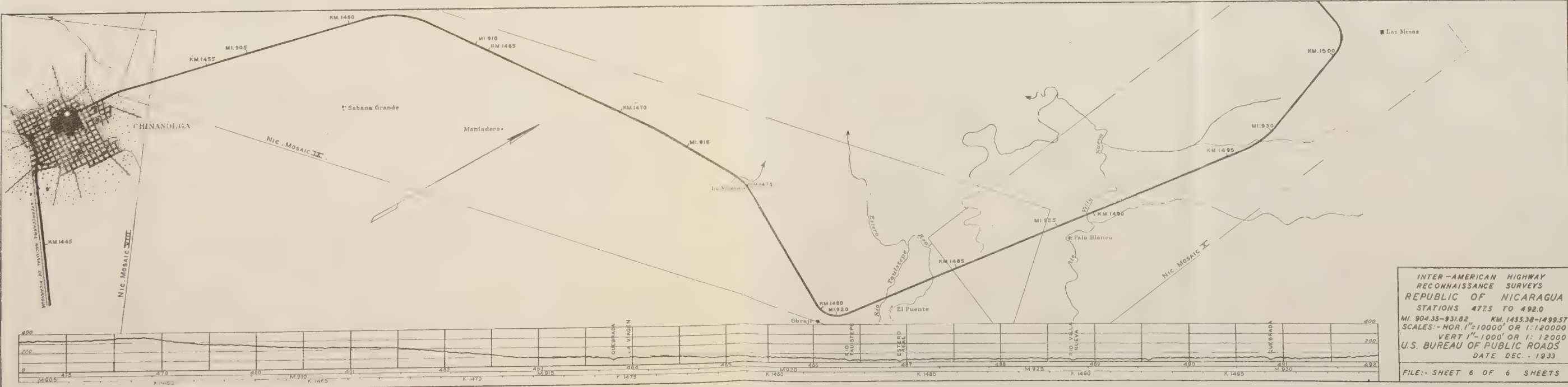


PLATE 34.

PROPOSED INTER-AMERICAN HIGHWAY

REPORT OF A RECONNAISSANCE SURVEY FOR THE
PROPOSED INTER-AMERICAN HIGHWAY

PART V.—REPUBLIC OF HONDURAS

BUREAU OF PUBLIC ROADS
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

HONDURAS

GENERAL SECTION

HISTORY

Columbus first sighted Central American soil when he descried the present Cape Honduras in August 1502, during his fourth and last voyage. He proceeded southward and on September 12 took refuge from a storm at a point which he named Cape Gracias a Dios.

The first settlement was made by Cristobal de Olid under orders from Hernando Cortes, in Mexico. Reports of gold and silver tempted Olid to set up an independent government, following which Cortes made his memorable march from Mexico over mountains and through jungles to assume control. He founded Puerto Cortes in 1525, reestablished order, and returned to Mexico in 1526. Honduras was incorporated into the captaincy-general of Guatemala in 1539.

Through a constituent assembly Honduras declared its freedom, sovereignty, and independence October 26, 1838. A constitution was adopted in 1848 which provided for freedom of conscience and religion. Shortly thereafter a controversy arose with Great Britain respecting the boundary of the colony of Belize which ended by the conceding of the British claims and the passing of British Honduras under English control.

In 1885 Honduras agreed to cooperate with President Barrios of Guatemala in his plan to establish a Central American republic, but with the death of Barrios Honduras made peace with El Salvador, Costa Rica, and Nicaragua. Honduras was not recognized by Spain as an independent republic until November 17, 1894, when a treaty was entered into by the two countries.

In 1895 Honduras, Nicaragua, and El Salvador attempted to perfect a common political organization to handle their external relations, and the following year the President of the United States recognized the federation by receiving its minister at Washington. In 1898 at Managua, Nicaragua, a constitution of the United States of Central America was executed which provided for the admission of Costa Rica and Guatemala into the federation. A provisional executive council for the union was established at Amapala, but El Salvador soon broke away and the confederation disintegrated.

In 1904 President Bonilla convoked a constituent assembly at which a constitution was promulgated. Among other provisions was one for a unicameral congress. Honduras has operated under this constitution up to the present time.

GEOGRAPHY, TOPOGRAPHY, AND AREA

Honduras is the third largest of the Central American republics, its area being about 46,250 square miles (120,000 square kilometers).¹ It is bounded on the north by the Atlantic Ocean; on the east by Nicaragua; on the south by Nicaragua, El Salvador, and the Pacific Ocean; and on the west by El Salvador and Guatemala. It lies within latitudes 12° and 16° north, and longitudes 83° and 90° west of Greenwich.

The proposed location of the highway is generally along the Pacific coast, close to the Gulf of Fonseca, in the Provinces of Valle and Choluteca, with a connecting road consisting of the present highway of the south, from San Lorenzo to Tegucigalpa, through the Provinces of Choluteca, Valle, and Tegucigalpa.

The interior of the country consists of irregular and much eroded mountain ranges interspersed with tablelands and fertile valleys along some of the larger streams. There seems to be no particularly well-defined and continuous range of mountains traversing the country, although it is intersected from north to south through Comayagua by a pronounced valley with a comparatively low maximum elevation, which was advocated by Squires as the location for an inter-oceanic railroad.

Near the Pacific and Atlantic coasts are found areas of low-lying, level plains of varying widths. Those along the Atlantic are the more extensive and cultivation is carried on here to a larger extent than on the Pacific side. This is probably due to the greater fertility of the land and the more favorable atmospheric conditions. Between these coastal plains and the mountains of the interior are scattered foothills of varying heights, seemingly without order or regularity, and these present formidable obstacles to railroad and road construction.

The country is well watered by many streams, which in general flow northeast or southwest. The principal ones flowing to the northeast into the Atlantic Ocean are the Chamelecon, Ulua, Tinto, Patuca, and Wanks; and those flowing to the southwest and emptying into the Pacific Ocean are the Negro, Choluteca, Nacaome, and Goascoran. The Negro defines in part the boundary between Honduras and Nicaragua and the Goascoran that between Honduras and El Salvador.

All of the rivers flowing toward the Pacific Ocean empty into the Gulf of Fonseca which is bordered by

¹ Recently the Republics of Guatemala and Honduras have agreed upon the location of the boundary between them, and this will alter the approximated areas of each country.

low, flat coastal plains rising very gradually to the foothills to the north and northeast. During the dry season these plains are practically devoid of vegetation and are extremely arid and dusty, and during the wet season large areas are rendered useless by the rains which transform them into mud bogs and lagoons.

The country lies entirely to the northeast of the volcanic range and there are no active volcanoes in its territory, although the soil in many places gives evidence of the fact that it is of volcanic origin. The Gulf of Fonseca lies in direct line between the volcanoes of Nicaragua and those of El Salvador, and probably is the result of some volcanic disturbance remote in time.

CLIMATE AND RAINFALL

The temperature of Honduras varies from tropical along the lowlands and coastal plains bordering the Atlantic and Pacific Oceans to a very equable, almost temperate, climate in the mountain regions and elevated plateaus. The mean temperatures are approximately 85° F. for the coastal plains, and 60° F. for the mountain regions. This difference and change in temperature is very noticeable in proceeding from near sea level to the elevated interior country and is due almost entirely to the differing altitudes.

In the mountainous sections the nights are always pleasant and the only time when the heat becomes at all noticeable is during midday when occasionally there is no appreciable movement of air. But along the coastal plains there are frequently nights that are quite oppressive, and the middle of the day is usually very hot.

There are two seasons prevailing throughout the Republic: The wet season, which extends approximately from May to December; and the dry season, from January to April, during which there is practically no rain along the coastal plains, but occasionally light showers in the mountains.

The annual precipitation varies with the locality and has never been accurately determined, since few records have been kept. It is probably 100 to 125 inches along the coasts, and slightly lower in the mountainous regions. Rain occurs practically every day during the rainy season, principally in the afternoons. It is not generally of long duration, but is very intense and there may be several downpours during an afternoon, between which the sun shines with intensity and the humidity is great, particularly in the lower altitudes and along the coasts. There is much more rainfall along the Atlantic than along the Pacific coast.

POPULATION

According to the census of 1930 the population of Honduras was nearly 860,000, an increase of more than 300,000 over the census of 1910. The density of population is 18 per square mile. In round numbers, the

population is distributed by Departments as given in table 1.

The population of the principal towns and cities in 1930 is shown in table 2.

TABLE 1.—Population by Departments in 1930

	Population
Atlantida.....	32, 000
Choluteca.....	69, 000
Colon.....	32, 000
Comayagua.....	42, 000
Copan.....	67, 000
Cortes.....	58, 000
El Paraiso.....	57, 000
Gracias.....	64, 000
Intibuca.....	39, 000
Islas de la Bahia.....	6, 000
La Paz.....	39, 000
Ocotepeque.....	38, 000
Olancho.....	54, 000
Santa Barbara.....	61, 000
Tegucigalpa.....	120, 000
Valle.....	40, 000
Yoro.....	42, 000
Total.....	860, 000

TABLE 2.—Population of principal cities and towns in 1930

Place	Department	Population
Tegucigalpa.....	Tegucigalpa.....	40, 049
Comayagua.....	do.....	12, 920
San Pedro Sula.....	Santa Barbara.....	24, 292
La Ceiba.....	Atlantida.....	13, 073
Choluteca.....	Choluteca.....	12, 371
El Progreso.....	Cortes.....	10, 920
Juticalpa.....	Olancho.....	10, 809
Santa Rosa.....	Copan.....	10, 807
Danli.....	Paraiso.....	10, 524
Nacaome.....	Valle.....	10, 310
Tela.....	Atlantida.....	9, 938
Puerto Cortes.....	Cortes.....	9, 430
Cedros.....	Tegucigalpa.....	9, 402
Pespire.....	Choluteca.....	9, 212
Trujillo.....	Colon.....	8, 827
Comayagua.....	Comayagua.....	8, 778
Olancho.....	Yuro.....	8, 763
Yoro.....	do.....	7, 891
Iriona.....	Colon.....	7, 780
Siguatopeque.....	Comayagua.....	7, 544
El Corpus.....	Choluteca.....	7, 489
Copan.....	Copan.....	7, 089
Total.....		258, 218

About 70 percent of the population may be classed as rural. By percentages, those engaged in agriculture and stock raising account for 24.4 percent; domestic, 27; manufactures and mining, 2.7; government and professional, 1.2; miscellaneous, 0.3; and without, or engaged in unproductive, occupations, 44.4. A still further classification by the 1930 census is given in table 3.

TABLE 3.—Classification of occupations according to the 1930 census

	Number engaged
General agriculture.....	205, 732
Miscellaneous agriculture.....	482
Manufactured foods and drinks.....	1, 467
Dressmakers, tailors, barbers, etc.....	14, 269
Furniture makers and builders.....	6, 611

TABLE 3.—*Classification of occupations according to the 1930 census—Continued*

	<i>Number engaged</i>
Wagoners, electricians, printers, jewelers, cigar makers, etc.....	3, 207
Other skilled trades.....	5, 607
Transportation: Aerial, maritime, river, railways, highways and streets, and communications.....	2, 485
Commerce.....	4, 627
Military and police.....	572
Professions.....	5, 232
Domestic occupations.....	229, 123
Miscellaneous.....	2, 556
Without occupation, and unproductive occupations....	372, 185
Total.....	854, 155

ECONOMIC SECTION

National wealth.—As with El Salvador and Nicaragua, so with Honduras: There are very little data available upon which to base a calculation as to the national wealth. Observation leads one to believe that the standard of living in Honduras is, in general, about on a par with that of Nicaragua. However, the large number of employees of the American fruit companies on the banana plantations and docks (nearly 60 percent of all Central American bananas comes from Honduras) would suggest that the per capita income of the Hondurans is a trifle higher than that of the Nicaraguans. But, accepting the figure set for Nicaragua, namely, an income of \$200 annually for a family of five, a national income of approximately \$35,000,000 is indicated. If we assume, as has been done with El Salvador and Nicaragua, that national income bears a ratio to national wealth of 1 to 4, the wealth of Honduras would be in the neighborhood of \$140,000,000. Of this, nearly \$80,000,000 is made up of direct foreign investments—90 percent of them American and 8 percent British. More than half of the American investments is controlled by three American fruit companies. This would mean a net wealth of the Honduran people of \$60,000,000, or a per capita of only \$70 due, of course, to the fact that 57 percent of the entire national wealth is in foreign hands. It is the opinion of many that Honduras, the least developed of the Central American countries, is potentially the wealthiest.

Employment and wages.—Wages vary greatly in different sections and for different occupations. They range from 20 cents a day for domestic servants (\$6 a month and food) to \$1.25 in the more skilled occupations. Road workers are being paid from 30 to 80 cents a day.

PRODUCTS AND INDUSTRIES

Agriculture.—Of the nearly 30,000,000 acres of land comprising the superficial area of Honduras ² the Di-

² By award of a Special Boundary Tribunal made early in 1933 Honduras lost some territory, the area of which has not yet been accurately determined.

rector General of Agriculture, Tegucigalpa, estimates something over 2,500,000 acres, or 8½ percent, to be under cultivation of some sort. By Provinces, the cultivated areas are shown in table 4.

TABLE 4.—*Cultivated areas, by provinces*

<i>Province:</i>	<i>Acres</i>
Atlantida.....	175, 500
Choluteca.....	133, 000
Colon.....	128, 000
Comayagua.....	183, 000
Copan.....	92, 000
Cortes.....	562, 000
El Paraiso.....	128, 000
Gracias.....	122, 000
Intibuca.....	57, 000
Islas de Bahia.....	62, 500
La Paz.....	112, 000
Ocatepeque.....	59, 000
Olancho.....	137, 000
Santa Barbara.....	160, 000
Tegucigalpa.....	152, 000
Valle.....	79, 000
Yoro.....	183, 000
Total.....	2, 525, 000

Of these 2,525,000 acres of land under cultivation, the Director General of Agriculture lists 860,000 acres devoted to bananas, 737,000 to corn, 523,000 to pasture, 163,000 to sugarcane, and 142,000 to coffee. Statistics on agriculture for Honduras as a whole are lacking, but for the four departments directly affected by the proposed inter-American highway—namely, Choluteca, Valle, Tegucigalpa, and La Paz—we have, as of 1930, the figures given in table 5.

TABLE 5.—*Agricultural statistics for the departments affected by the proposed highway, as of 1930*

<i>Product</i>	<i>Department</i>			
	<i>Choluteca</i>	<i>Valle</i>	<i>Tegucigalpa</i>	<i>La Paz</i>
Corn.....manzanas ¹	9, 350	5, 256	1, 033	2, 732
Beans.....do.....	572	463	84	75
Rice.....do.....	839	137	20	23
Yuca.....do.....	462	73	4	11
Potatoes.....do.....	9	-----	10	-----
Tobacco.....do.....	39	-----	2	-----
Coffee.....do.....	2, 910	3	26	75
Oranges.....trees.....	7, 590	3, 497	661	540
Lemons.....do.....	1, 683	849	678	45
Avocados.....do.....	5, 443	7, 752	284	400
Other fruit trees.....do.....	17, 752	14, 578	459	1, 500
Horses.....head.....	4, 943	2, 392	922	475
Mules.....do.....	2, 020	792	158	169
Donkeys.....do.....	890	279	276	22
Cattle.....do.....	44, 556	18, 030	1, 685	1, 180
Sheep.....do.....	7, 198	4, 015	120	88
Hogs.....do.....	18, 596	11, 370	1, 454	1, 100
Poultry.....do.....	29, 355	44, 797	13, 000	5, 671
Eggs.....dozen.....	137, 544	61, 833	10, 583	54, 516
Butter.....tons.....	68	3	4	-----
Cheese.....pounds.....	30, 075	1, 445	1, 112	-----
Farmers and stockraisers.....number.....	9, 349	1, 394	161	147

¹ About 1¼ acres.

Another governmental source (Resumen del Censo Agropecuario de la Republic de Honduras, Tegucigalpa, Diciembre de 1931) gives for the entire country the figures shown in table 6.

TABLE 6.—*Livestock and fruit tree statistics for the entire country as of 1931*

Livestock:	Number
Horses.....	167, 036
Mules.....	45, 013
Donkeys.....	12, 487
Swine.....	298, 312
Cattle.....	516, 811
Sheep.....	12, 851
Goats.....	8, 454
Fowls.....	1, 961, 130
Fruit trees:	
Orange.....	341, 447
Mandarine.....	2, 646
Lemon.....	64, 399
Avocado.....	194, 849
Plum.....	41, 390
Peach.....	14, 112
Coconut.....	1, 996, 983
Apple.....	37, 742
Fig.....	11, 088
Miscellaneous.....	163, 034

Table 7 shows production for that year (1931) to have been as follows:

TABLE 7.—*Production statistics for the entire country as of 1931*

Corn.....	quintals..	3, 772, 304
Rice.....	do.....	138, 048
Beans.....	do.....	594, 252
Potatoes.....	do.....	227, 700
Coffee.....	do.....	674, 835
Sugarcane.....	do.....	52, 385, 000
Tobacco.....	do.....	73, 323
Bananas.....	bunches..	137, 248, 000
Henegén.....	quintals..	36, 576
Honey.....	bottles..	30, 438
Butter.....	arrobas..	85, 876
Cheese.....	do.....	1, 167, 516
Eggs.....	number..	95, 549, 350
Oranges.....	do.....	23, 970, 600
Mandarines.....	do.....	793, 800
Lemons.....	do.....	22, 539, 650
Coconuts.....	do.....	299, 397, 450
Avocados.....	do.....	48, 712, 250

Four of the great undeveloped Departments of Honduras are Olancho, Paraiso, Yoro, and Choluteca. The last is crossed by the proposed location and all but the last would be indirectly affected by the highway. The soils in these Departments are suitable for many kinds of fruits and vegetables. Figs, grapes, peaches, plums, and apricots of excellent quality are grown. Rice grows without irrigation and wheat will grow in the highlands, as well as many of the temperate zone vegetables. A local variety of cotton immune to the boll weevil offers possibilities as a remunerative crop. Honduran tobacco has on occasion won in competition with other high-grade tobaccos. It is grown to some extent in most of the Departments, but the tobacco of Copan, Gracias, and Paraiso is the best. Growers should be instructed as to proper curing; but as it is, considerable tobacco is exported to Guatemala

¹ From Resumen del Censo Agropecuario de la Republica de Honduras.

and El Salvador and it has been shipped to Germany and Peru.

A great variety of medicinal plants is indigenous to the country, among which may be mentioned Peruvian balsam, balsam of Tulu, liquid amber, copaiba, and the finest sarsaparilla obtainable. Many of these plants could be profitably cultivated. There is a huge area in the north covered with cohune, coyah, and coquito palms, which suggests possibilities eventually for palm-oil production.

There are also possibilities for the production of kapok. It is claimed that Honduran kapok is superior to that of the East Indies, but little is being exported.

Citrus fruits are equal in flavor to those of Florida.

Timber resources.—The most important cabinet or hard woods growing in commercial quantities in Honduras are mahogany, grenadino, moro, alcaboro, maringito, amarillo, maria, nazareno, guayacan (known to the trade as, but not true, *lignum vitae*), cocobolo, walnut, and rosewood. There are many other varieties of lesser importance. While no cruise figures are available, it is known that the amount of cedar, of which there are several species, runs into many millions of feet. In the territory of Mosquitia there is a vast stand of cedar distributed over an area of 1,500 square miles, but inaccessible for lack of transportation. Other stands are to be found in Copan. According to a recent survey by the Ulen Engineering Corporation:

Large quantities of mahogany and other valuable hardwoods are found in the northeast and smaller quantities in the interior valleys and near the southern coast. The higher plateaus and mountains are generally timbered with excellent longleaf yellow pine and a species of white pine, but in places, particularly those best adapted to coffee raising, they are timbered with hardwoods.

Pitch is collected from the pine trees on a very small scale and by the most primitive methods.

Mining.—Honduras possesses a large variety of ore and mineral deposits, few of which, with the exception of gold and silver, have been worked on a commercial scale.

Gold.—Many thousands of acres of gold placers have been located in the Departments of Olancho, Yoro, El Paraiso, and in the territory of Mosquitia are still to be found vestiges of old Indian and Spanish workings, particularly on the bars. The river beds could not be worked by them because of the depth of gravel and the flow of water. These can only be worked by modern machinery. According to recent reports, an American company is preparing to make reconnaissances and tests for gold in the Department of Olancho. The last authentic record left by the Spaniards is for the period January–August 1811, Department of Olancho. During the 8-month period, 1,421 arrobas of gold, valued at more than \$11,000,000, were recovered. There are said to be many gold ore beds that have never been

worked. An American engineer recently visited Honduras and made an airplane reconnaissance for gold locations along the river valleys in the vicinity of Juticalpa with apparently favorable results. In June of this year (1933) two other mining men arrived in Tegucigalpa with some 8 tons of equipment and machinery to be taken to the vicinity of Juticalpa. The so-called "Honduran Venture" intends to use a new placer mining process by which a dredge takes up and extracts the gold from such a large volume of ore that it pays even if the gold content is but little.

Silver.—The Rosario Mining Co. (New York) works a silver mine at San Juancito, about 15 miles from Tegucigalpa, and even at the 1932 price of silver this company made good profits. The Rosario mine has been in continuous operation for 45 years and has paid large dividends.

Copper.—Large deposits of copper are reported in the Departments of Olancho, Yoro, Santa Barbara, and Cortes. There is an outcropping in Olancho, said to be three-quarters of a mile long and averaging 130 feet in width, depth unknown. All the known copper deposits carry heavy gold values.

Lead and zinc.—In the Department of Valle, about 60 miles from the Gulf of Fonseca, is a deposit over 2 miles in length, 700 feet wide, and with an estimated depth of 1,200 feet. This deposit assays 7 percent zinc, 14 percent lead, some silver, and traces of gold. It also carries the largest known percentage of zinc manganese silicate (franklinite), a deposit said to be larger than that at Franklin, N.J. Other large deposits of zinc and lead are found at Cedros in the Department of Tegucigalpa.

Iron.—At Agaltica, Department of Comayagua, 30 miles north of Tegucigalpa, between Cedros and Talanga, is a deposit of many millions of tons of 61 percent magnetic iron ore. At a depth of 190 feet, this bed runs into a bed of pyrites, the second largest known deposit of pyrites between Mexico and Colombia, the largest being in the territory of Mosquitia across from the Olancho line. The Mosquitia deposit is about $2\frac{1}{2}$ miles long and a mile wide, known depth 400 feet. It carries hematite above and iron sulphide below. In the Departments of Comayagua, La Paz, and Yoro are several good veins of manganese. Magnetite and arsenico-pyrite are known in the Department of Colon, 11 miles from the railroad out of La Ceiba. This deposit is said to be $1\frac{3}{4}$ miles long and a quarter of a mile wide, carrying 27 percent arsenic.

Other metals reported from time to time as existing in Honduras are antimony, mercury, and nickel. Concessions have been recorded for mining the following materials, thus suggesting their presence in the country: Asphalt, bauxite, chalk, coal, copper, crystal, gypsum, iron, kaolin, marble, nickel, opals, saltpeter, and zinc.

Deposits of excellent limestone exist, some grades of which are especially suited for the cutting of structural stone, while others are well adapted for the manufacture of portland cement. Inexhaustible sources of prime road and bridge building materials are found over the entire country, an advantage that will gradually aid in the progressive development of Honduras by assuring cheap materials for the economical construction of complete highway and railway systems.

The lack of more economic means of transporting the requisite mining machinery and equipment prevents the development of these extensive natural resources. Nearly 1,000 mining concessions have been granted by the Government of Honduras to individuals and companies who pay 25 cents annually per hectare for the privilege of exploitation. Such a nominal sum, together with the privilege of free entry for mining equipment, stimulates new exploitation.

MANUFACTURING

Industrial plants and their locations include: Two flour mills, one at Puerto Cortes, and the other at San Pedro Sula; at San Pedro Sula, 2 breweries, 1 large cigar and cigarette factory, 3 very good furniture factories, 1 candle, 1 candy, 1 overalls, and 2 shirt factories; at La Ceiba, 1 distillery, 1 brewery, 1 candy, and 1 shirt factory.

Shirts and fine straw hats are made in Santa Rosa, and fine straw hats are also produced in Santa Barbara. There is a \$1,300,000 sugar mill at La Lima and a number of ice plants, small cigar factories, small mills, tanneries, and railroad shops are scattered throughout this region.

The only industry of importance in south Honduras is the Rosario gold and silver mining property. However, there are 2 soap factories, 2 ice plants, 4 shoe factories, 2 breweries, 1 candle factory, 3 sawmills, 1 match, 6 soft drink, and several cigar and cigarette factories, 2 furniture and cabinet shops, 1 small foundry, and 1 packing house. South Honduras produces most of the lard consumed, and has one factory making luggage from alligator and snake skins, also several tanneries. Practically all of the men's and women's wear is produced locally, including shoes, although American shoes are preferred by those who can afford them. There is a boat-building industry at San Lorenzo on the Gulf of Fonseca.

TRANSPORTATION AND COMMUNICATION

Ocean transport.—There is direct steamship service between the United States and the banana ports of northern Honduras, Puerto Cortes, Tela, Puerto Castilla, and La Ceiba. Regular sailings are maintained between the first three mentioned places and New York and New Orleans by the United Fruit Co.,

and the Vacarro Line provides a service between La Ceiba and New York and New Orleans. Communication with other points along the Caribbean coast is had by schooners and motor boats.

Steamships in the Pacific service between Panama and San Francisco usually make Amapala, the only Honduran port on the Pacific, a point of call. This is the best harbor on the Pacific coast of Central America, admitting large vessels and affording adequate protection. Amapala is located on an island 24 miles off the mainland, and passengers and freight must therefore be transferred by motor boat to the mainland at San Lorenzo, the terminal of the highway to the capital. There is also a launch service to La Union, Republic of El Salvador.

As of August 1932, the following vessels operating on the Atlantic side were registered under the Honduran flag: 33 steamers, with a total tonnage of 56,178 tons, belonging to the fruit companies and subsidiaries; 10 schooners, with a total tonnage of 286; 17 motor vessels, aggregate tonnage 563; 2 dugouts, tonnage 15; 2 boats, tonnage 7; and 12 sloops, tonnage 104. For the Pacific coast the Honduran registry consisted of: 1 motor yacht, tonnage 20; 9 motor vessels, tonnage 81; 17 sail lighters, tonnage 360; 2 towing lighters, tonnage 60; and 4 dugouts, tonnage 33. This gives the Honduran merchant marine an aggregate tonnage of 57,707.

Highways.—In general, Honduran roads are poor and do not offer suitable connections with the rail lines, the navigable rivers, or the main automobile highway connecting the National Railway with the Pacific Ocean. Aside from this latter route two other long roads, linking the Provinces of Olancho and Paraiso with the two oceans, have been projected and some work has been done on them. Progress, however, is slow, owing to difficulties of construction and to lack of finances. Completion would make accessible a large territory through which the only previous means of transportation has been by mule back. Such roads would be connections of the proposed inter-American highway.

While good motor highways are recognized in Honduras as a desirable means of land development through creating a comparatively rapid access to productive areas, the present low purchasing power of the inhabitants served permits very few of them to purchase and operate automotive vehicles.

The roads of Honduras are classified as follows: (a) Highways (caminos carreteros), macadamized 20 feet (6 meters) wide, constructed and maintained by the Department of Public Works or by private persons under concessions or contracts; (b) bridle roads (caminos de herradura), natural dirt roads, 10 feet (3 meters) wide, suitable for beasts of burden, constructed by the Department of Public Works but maintained by the municipalities; (c) rural pack trails (caminos rurales),

crude paths too poor to be called roads, built and maintained by the municipalities, under supervision of the Department of Public Works.

As of July 1932, the automotive division of the United States Department of Commerce, reported the following roads existing:

	Miles
Waterbound macadam.....	132
Graded and drained earth.....	184
Earth (dry season only).....	295
Total.....	611

An intercoastal highway extends from the railhead of the National Railroad at Potrerillos to San Lorenzo on the south coast, passing through Tegucigalpa. Its sections are as follows:

San Lorenzo to Tegucigalpa.—This section has a total length of 81 miles (130 kilometers), is 20 feet (6 meters) wide, and has maximum grades of 12 percent, with an average of 8 percent. It consists of the Carretera del Sur (Highway of the South) and a section of the intercoastal highway. It is constructed of macadam, is well kept, and is considered a good motor road in dry season, but rather heavy during the rainy season from May to November. There is a bus service over this road 3 times each way per week. Time of trip is from 5 to 8 hours.

It is proposed to include this section in the inter-American highway as a means of connecting the capital, Tegucigalpa, with the capitals of the other countries, and of reaching a greater area in Honduras than that immediately contiguous to the located line along the Pacific coast.

Tegucigalpa to Comayagua.—A total length of 64 miles (103 kilometers), with a width of 20 feet (6 meters), and maximum grades of 14 percent. This is the Carretera del Norte (Highway of the North), a section of the intercoastal highway, designed to provide communication between the capital and the north coast. It is a macadam road, well kept, and is considered a good dry-season road.

Comayagua to Siguatepeque.—This is a further section of the intercoastal highway, with a total length of 25 miles (40 kilometers) and a width of 23 feet (7 meters). It is a good motor road in dry season.

Siguatepeque to Lake Yojoa.—This section of the intercoastal highway is 26 miles (42 kilometers) long, has a width of 20 feet (6 meters), and has maximum grades of 10 percent. It is a good road in dry season.

Lake Yojoa to Potrerillos.—This is a section on the intercoastal highway running north of the lake, 25 miles (40 kilometers) long, and 20 feet (6 meters) wide, designed to connect the lake with the southern terminal of the railroad from Puerto Cortes. Travel is difficult in the wet season.

The charges for truck haulage over this highway are very high. The Government intends improving and resurfacing the road eventually, after which trucking

charges probably will be reduced. On this route it is necessary to ferry all commodities for 12 miles across Lake Yojoa, which also adds to the expense. A new route through the Comayagua Valley is contemplated which will eliminate the ferry, but no one knows definitely when this road will be built.

Potreros, at the northern terminus of this highway, is 58 miles from Puerto Cortes by rail. The total distance, coast to coast, by rail and road is 280 miles.

From San Lorenzo, the southern terminus, lighterage is necessary across the Gulf of Fonseca and around Tigre Island to deep water at Amapala, 28 miles. This service is completely controlled by two large importing firms.

The cost of delivery through the port of Amapala is excessive and an instance is cited where 62 pieces of printing equipment were carried from New York to Amapala for \$171.60 freight charges, while the disembarkment, lighterage to San Lorenzo, and auto haul to Tegucigalpa came to \$155.06.

Olancho Highway.—This highway, planned to connect Tegucigalpa with the Department of Olancho, has been built for a distance of 40-odd kilometers and will be continued eventually, in all probability, to Juticalpa and possibly further.

Other roads projected or with initial construction already undertaken are: Progreso to Yoro, Talanga to Yoro, Comayagua to Yoro, Tegucigalpa to Danli, Danli to the frontier of Nicaragua, Quimistan Highway, Santa Barbara Highway, inter-American Highway. The longest of these projected roads is the Quimistan Highway, which will probably have a total extension of about 124 miles (200 kilometers). It is planned to pass through the following municipalities: Cofrodia, Santa Cruz Minas, Quimistan, San Marcos, Chiquila, Entrada, San Nicolas de Copan, Trinidad de Copan, Vivistoria, and Santa Rosa de Copan. The country to be traversed consists of rolling bottom lands covered with pines in places as far as Entrada; beyond that point it will ascend from the valley of Chamelecon to the plateau on which Santa Rosa is situated, crossing mountainous country with frequent steep grades, and from there to Ocotepeque. A beginning has been made on this highway.

Railways.—The total length of all railroad lines in operation is approximately 1,200 miles. All the railroads are located on the north coast, and with the exception of the National Railway of Honduras, the whole of the railway system of the Republic is owned by the large fruit companies. Although the railroads of these companies are primarily intended for transporting fruit, facilities are provided for passenger traffic. The most important of the lines are the National Railway from Puerto Cortes, to Potrerillos; Trujillo Railroad, operating out of Trujillo and Puerto Castilla into the interior, which will eventually reach

Juticalpa; Standard Fruit & Steamship Co. line, operating from La Ceiba; Cuyamel Fruit Co., private line in the Cuyamel district; Tela Railroad in the Tela region.

The National Railway was originally conceived to provide a means of rail communication across the Republic from the north shore to the Bay of Fonseca on the Pacific side, and give the capital city, Tegucigalpa, access to both coasts. However, it has never been carried more than 60 miles south of Puerto Cortes, slightly less than a third of the distance to the capital. Plans have been entertained for some time for extending the line to Lake Yojoa, from where automobile transportation is available to the capital and the Pacific.

Honduras has been handicapped for years by lack of rail transportation, largely because of the outstanding lien of about \$26,000,000 of Honduran Government bonds issued in 1867-70 for the purpose of building an elaborate system of railroads throughout the Republic.

These bonds, a lien on all the resources of the country, were sold in England, and the Honduran Government established a fiscal agency in London with authority to check out the funds upon estimates furnished by the contracting company.

About \$1,500,000 of this fund was actually applied to constructing the road from Puerto Cortes to Pimienta on the Rio Ulua, incidentally the first railroad built in Central America, and the remainder was said to have been squandered. The bonds were defaulted as Honduras had no assets with which to pay interest and back interest accumulated until the total debt amounted to over \$150,000,000.

Under these conditions Honduras had no outside credit as, repudiated or not, these bonds in fact constituted a prior lien. After a lapse of some three score years, an agreement was reached with the British bondholders by which the debt was fixed at £452,000, with cumulative interest at 8.8 percent for 30 years to satisfy the period in default, or a total of about £1,200,000. Service on this sum is secured by a 3-percent stamp tax on consular invoices.

Two proposals have been offered the Government by American firms for the continuation of the National Railway to the Gulf of Fonseca on the Pacific coast, both applicants agreeing to finance construction from the proceeds of bonds to be issued by the Government. At present the subject appears to be in abeyance.

It is to be noted that all southern and central Honduras is without rail transportation and the proposed highway becomes, therefore, of particular significance, lying as it would along the Pacific or south coast and connecting with Tegucigalpa and through that city with all connected points in the interior.

INLAND WATERWAYS

Lakes.—The only lake of any importance in Honduras is Lake Yojoa. It forms part of the southeastern boundary of the Department of Santa Barbara and the western boundary of the Department of Cortes. It is about 25 miles in length by from 5 to 8 miles in width. The exact depth is unknown, but it is believed that it was formed after the top was blown off an extinct volcano. The elevation is slightly over 2,000 feet above sea level. It is remarkable in having not less than 3 outlets: From its southern extremity, which is about 8 miles broad, flow out two large streams, the Rio Jaitique and the Rio Sacapa. The third outlet of the lake which flows from its northern extremity is the Rio Blanco, a narrow but deep and rapid stream, emptying into the Rio Humaya.

This lake is utilized in connection with the transportation of freight and passengers from Puerto Cortes on the north coast to Tegucigalpa, and vice versa. The National Railway of Honduras extends from Puerto Cortes to Potrerillos, from which point to Jaral at the northern end of Lake Yojoa there is a section of the Carretera del Norte (Highway of the North). At Jaral freight and passengers are disembarked to launches which proceed to Pito Solo, located at the southern end of the lake, where passengers are embarked on busses and the freight on trucks, to continue on the remaining section of the Highway of the North to Tegucigalpa.

Rivers.—The most important rivers of Honduras are the Ulua, Chamelecon, Aguan, Tinto (or Negro), Patuca, and Motagua, all flowing into the Caribbean; and the Goascoran and the Choluteca, flowing to the Gulf of Fonseca on the Pacific side. Those on the Atlantic side are far larger than on the Pacific. The Ulua carries off the waters from a very extensive fertile area known as the Plain of Sula, and is navigable for a distance of 125 miles, permitting boats of 20-foot draft to pass. This source of transportation, together with two short lines of railway to the north coast and its highway connection with the national capital and the Pacific, make this plain one of the most important, commercially, of the Republic.

The Aguan, Patuca, and Segovia are navigable for light-draft vessels for short distances. The territory served, however, is less important from a commercial standpoint than that drained by the Ulua; some of it, particularly the extreme eastern portion, being sparsely settled and largely undeveloped. Much of the area is covered with dense tropical forests. The Segovia flows along the boundary of Nicaragua in unsettled territory.

The rivers on the Pacific side are generally shorter than those flowing to the north. The Goascoran for a part of its length forms a natural boundary between Honduras and El Salvador. This stream is only

navigable in places, but the Choluteca is navigable for light-draft boats for some distance from its mouth.

Airways.—While there are more than a score of airfields in Honduras, only about half afford safe landing in the rainy season, and only six will accommodate large-sized planes. They are without flood-lights and artificial drainage.

Pan American Airways calls at San Lorenzo twice weekly, both north and south bound. The proposed highway would mark the general course of this line through Honduras. This company now has a weekly service to and from Guatemala City. Transportes Aereos Centro Americanos (T.A.C.A.) runs daily planes between Tegucigalpa and San Pedro Sula, Tela, and La Ceiba, as do Empresa Dean and several planes operated by the Morgan company. T.A.C.A. also maintains twice-a-week service to San Salvador, Guatemala, and Managua. The S.I.C.A. company makes weekly trips from Tegucigalpa to San Lorenzo, Choluteca, and return. There are regular twice-a-week services to most of the fields in the western and eastern sections of the country. There is one plane operated by Ernest Voss, a "taxi" service, making short hops out of San Pedro Sula. The United Fruit Co. operates a private plane for its own service.

Automotive statistics.—In 1925, 330 passenger automobiles were registered in Honduras and early in 1933 the number had increased to 1,000, a rise of more than 200 percent. A similar increase occurred in the number of trucks registered, with 86 in the earlier year and 253 in 1933. Twenty-five busses were registered in 1933, giving a total of 1,278 automotive vehicles registered. The distribution of ownership by regions is not known, but is assumed to be mainly in the region of the capital where most of the improved roads are located and where there is the greatest concentration of population.

HIGHWAY ECONOMICS

Existing bus routes.—In addition to the San Lorenzo-Tegucigalpa service previously mentioned, the American vice consul at Tegucigalpa reports the operation of two trucks between Tegucigalpa and the railhead at Potrerillos, belonging to Empresa Dean and Empresa Alvarez, aviation companies. These trucks are used for mail and freight and occasionally carry passengers.

Future highway development.—The following have been suggested as feasible projects for future development as bus routes:

1. From Hacienda Las Lojas up the Valley of Guasaule.
2. From Choluteca up the Rio Choluteca toward Yusecan.
3. From Alianza on the Rio Goascoran at tidewater up the Goascoran and across the Continental Divide to the waters of the Rio Humaya. This could con-

nect at San Antonio with the Highway of the North, Tegucigalpa via Comayagua, and thence to the Atlantic Ocean at Potrerillos.

Tourist and other private traffic.—No records are available concerning tourist traffic in Honduras. Boat passengers spend a few hours in the towns on the north coast, served by the banana trade and in Amapala on the Pacific coast. Commercial travelers use Tegucigalpa as their base of operations, preferring to enter by way of Amapala. There is, however, a growing rail and automobile passenger traffic from the Atlantic to Tegucigalpa.

Government bureau of highways.—The national highways at present are under the Minister of Promotion, Agriculture, and Public Works, and the duties of administration, location, construction, and maintenance are delegated to the Director General of Highways. The office of the Director General of Highways is in Tegucigalpa and all activities in road work are directed from there.

For the purpose of facilitating the administration of the road activities the republic has been divided into the following zones:

- Zone 1. Southern (Sur).
- Zone 2. Northern (Norte).
- Zone 3. Eastern (Oriental).
- Zone 4. Western (Occidental).

The principal roads of the several zones are as follows:

Zone 1. Highway of the South, Inter-American Highway, highway from Nacaome, highway from Choluteca.

Zone 2. Highway of the North, highway from Olancho, highway from Progreso to Yoro.

Zone 3. Highway from Tegucigalpa to Danli.

Zone 4. Highway from Quimistan, highway from Santa Barbara, highway of the East, highway to the frontier of Salvador via Marcala.

It is difficult to obtain accurate figures regarding road revenues and expenditures and the budget figures show a wide variation from the actual figures, where both sets are available. For the fiscal year 1931-32, the sum of 1,987,000 pesos (about \$995,000) was allotted for road construction and maintenance.

The actual expenditures on roads for the years 1926-30, according to available Ministry of Fomento and consular reports were as follows (in pesos): 1926-27, 741,396; 1927-28, 872,778; 1928-29, 758,248; 1929-30, 1,121,661.

Funds for road building expenditures are obtained from a number of sources, the complexity of which has made negotiations difficult for several foreign contractors who were interested in road building projects in Honduras.

Table 8 shows the sources of road revenues collected during the fiscal years 1926-27 and 1927-28 (in pesos), as reported by the Ministry of Public Works:

TABLE 8.—*Sources of road revenues collected during the fiscal years 1926-27 and 1927-28*

Source	1926-27	1927-28
	<i>Pesos</i>	<i>Pesos</i>
General road tax.....	388,258.92	425,784.08
General road tax on parcels post.....	4,821.15	5,221.94
Exportation of bananas.....	300,582.07	351,177.36
Miscellaneous credit items.....	23,222.34	104,379.69
Special road tax ("contribucion de caminos").....	25,655.31	31,952.43
Registration of mineral zones.....	15,893.79	18,534.20
Premium on exchange.....	6,646.34
Military redemptions.....	522.00	67.50
Total.....	765,601.92	937,117.20

By decree no. 7 of May 14, 1931, the Government has augmented the funds for road construction by providing (a) a special import tax of 10 centavos (about 5 cents) per gallon on the sale of gasoline; (b) a tax on each stem of bananas exported; (c) a tax on capital. Capitalists are divided into six classes, paying annually \$75, \$40, \$20, \$10, \$5, and \$4, respectively. Also the proletarians who are not exempt are obliged under the law to work on the roads 2 days a year, each day being commutable by payment of the rate for labor paid at the place where the work is performed. It was estimated that the 10-centavo (5-cent) tax on gasoline would produce a revenue of 500,000 pesos (\$250,000) per annum. The record fails to show whether this sum has actually been collected.

Certain funds, principally 15 percent of the special road tax (contribucion de caminos) go to municipalities for local roads, but comparatively few of such roads have been built. The local vehicle license fees are collected by the municipalities and are not necessarily expended on roads.

There is a prejudice against road tolls, and it is said that the constitution has been interpreted in such a manner that road tolls would be considered unconstitutional. No local or foreign bonds have been issued for the purpose of road financing.

It is interesting to note that during the fiscal year 1929-30, Honduras spent the sum of 86,607 pesos (approximately \$43,300) on that section of the inter-American highway which lies within its boundaries.

PUBLIC LANDS

Information regarding the extent and character of public lands in Honduras is not available.

FOREIGN TRADE

Imports.—Imports are many and various, and come mainly from the United States.

Table 9 gives imports of commodities exceeding \$50,000 in value for the fiscal year 1930-31, preceded, for comparison, by similar figures for the year 1921-22:

TABLE 9.—Imports of commodities exceeding \$50,000 in value

Import	1921-22	1930-31
Automobiles.....	\$109,505	\$109,000
Boots and shoes.....	303,224	280,807
Miscellaneous manufactures of leather, unspecified.....	39,911	52,967
Cement.....	97,028	94,668
Chemical products.....	310,839	121,078
Engines and boilers, etc.....	95,586	38,159
Foodstuffs, beverages, and liquors:		
Beer.....	60,347	22,446
Spirits, distilled.....	259,902	160,145
Wines.....	187,259	86,066
Flour.....	434,873	219,284
Lard.....	74,428	172,891
Meats, canned or preserved.....	217,963	74,291
Rice.....	164,231	168,223
Sugar.....	57,989	95,768
Food products, unclassified.....	145,920	74,773
Glassware.....	103,075	87,717
Hats.....	75,674	86,301
Hides and skins, tanned.....	52,942	78,179
Iron and steel manufactures.....	1,297,784	746,448
Locomotives and tenders.....	272,475	26,332
Lumber.....	742,880	225,848
Agricultural machinery.....	18,205	133,030
Electrical machinery and apparatus.....	138,370	154,550
Machinery and apparatus, not classified.....	394,967	237,261
Musical instruments.....	51,775	106,559
Oils, mineral.....	280,606	1,035,938
Paints and varnishes.....	139,784	77,754
Paper and cardboard and manufactures.....	194,735	185,953
Proprietary medicines.....	263,863	305,664
Railway cars and carriages.....	241,713	75,860
Ready-made clothing:		
Men's.....	337,279	298,623
All other.....	373,915	125,462
Rubber manufactures.....	69,441	74,564
Soap.....	71,545	100,137
Cotton textiles.....	2,151,226	1,293,742
Woolen fabrics.....	64,148	76,547
Silk fabrics.....	276,901	58,416
Total.....	10,172,308	7,361,441
All other products imported.....	2,631,951	2,929,559
Total imports.....	12,804,259	10,291,000

Exports.—Exports year after year consist chiefly of bananas, of which 28,961,000 stems, valued at \$17,306,000, were exported during the fiscal year 1930-31, a decrease from the exports of the previous year which were 29,084,000 stems, valued at \$22,981,000. Value of the banana exports declined further and seriously in the year 1931-32.

Table 10 shows the exports of leading commodities for 1921-22 and 1931-32:

TABLE 10.—Exports of leading commodities for 1921-22 and 1931-32

Export	1921-22	1931-32
Cattle.....	\$42,000	\$36,000
Bananas.....	3,386,000	13,950,000
Coconuts.....	101,000	97,000
Coffee.....	53,000	287,000
Sugar.....	697,000	105,000
Cattle hides.....	68,000	1,000
Deer skins.....	7,000	3,000
Tobacco, leaf.....		103,000
Gold and silver.....	¹ 736,000	² 2,742,000
Other commodities.....	296,000	257,000
Total.....	5,386,000	17,581,000

¹ Excludes specie.² Includes specie.

Bananas, together with gold and silver, represent each year well over 90 percent of all exports; thus it will be seen that without the banana industry Honduras in its present state of development would be of small trade importance. Export duty on bananas is 1½ cents gold per bunch. The banana industry yields the Government directly some half million dollars

annually, besides the much larger amount paid to labor. Without this income there would be little money available from other sources of taxation to support the political organization in Tegucigalpa which accounts by far for the greater amount of purchasing power of that city.

General imports and exports of Honduras offer an interesting comparison for the period since 1910. Figures during this period follow in table 11.

TABLE 11.—Comparison of imports and exports

Year ¹	Imports	Exports
1910.....	\$2,696,000	\$2,296,000
1920.....	12,861,000	6,945,000
1930.....	15,946,000	26,171,000
1931.....	10,291,000	20,028,000
1932.....	8,368,000	17,581,000

¹ Ended July 31.

The United States supplied 71.6 percent of imports in 1931 and took 72.4 percent of exports; in 1932 she supplied 76.2 percent of imports and took 67.6 percent of exports. The nearest competitors to the United States for Honduras' foreign trade are Germany and the United Kingdom.

An indication of the comparative importance of the various seaports in the foreign trade of the country is contained in table 12.

TABLE 12.—Value of exports by customhouse for the fiscal year 1929-30 ¹

Port:	Value
Amapala.....	\$1,308,197
Puerto Cortes.....	4,264,377
La Ceiba.....	2,474,820
Roatan.....	156,894
Trujillo.....	79,871
Tela.....	9,745,334
Puerto Castilla.....	7,557,771
Land or interior offices:	
El Paraiso.....	900
Choluteca.....	95,105
Valle.....	44,304
Gracias.....	12,893
Intibuca.....	5,303
Ocotepeque.....	56,441
Copan.....	341,050
Santa Barbara.....	12,958
Total.....	26,156,218

Puerto Cortes led the list of Honduran customs ports through which imports entered in 1929-30, with Amapala second, and La Ceiba third. San Lorenzo and Aceituno, a point on the mainland reached by coast-wise steamers and barges from Amapala, are both contiguous to the projected highway location, and must be depended upon as points from which distribution of goods from the principal port of entry will be made. The ports, tonnages, and values are shown in table 13.

¹ From Ulen & Co. report.

Government receipts and expenditures.—Total receipts and expenditures over a period of years have been given in table 14.

TABLE 13.—Ports, tonnages, and values of imports in 1929–30¹

Customhouse	Tonnage	Value
Port:	<i>Kilos</i>	
Amapala.....	12, 639, 969	\$3, 733, 159
La Ceiba.....	49, 244, 838	2, 950, 613
Puerto Cortes.....	72, 727, 585	5, 245, 663
Trujillo.....	1, 151, 214	412, 282
Roatan.....	79, 392	15, 547
Tela.....	28, 544, 513	1, 773, 633
Puerto Castilla.....	82, 523, 825	1, 735, 496
Land or interior offices:		
El Paraiso.....	375	4, 250
Choluteca.....	154, 467	18, 791
Valle.....	277	429
La Paz.....	12, 423	2, 803
Gracias.....	4, 271	4, 778
Ocoatepeque.....	206, 290	55, 945
Copan.....	26, 669	2, 739
Total.....	247, 316, 108	15, 946, 128

¹ From report on National Inter-oceanic Railway of Honduras, Ulen Engineering Corporation, Feb. 2, 1931.

TABLE 14.—Government receipts and expenditures

Year ¹	Revenues	Expenditures	Deficit	Surplus
	<i>Silver pesos</i>	<i>Silver pesos</i>	<i>Silver pesos</i>	<i>Silver pesos</i>
1913–14.....	5, 895, 194	5, 121, 334		773, 810
1919–20.....	6, 688, 976	7, 770, 585	1, 081, 609	
1924–25.....	8, 535, 946	7, 441, 395		1, 144, 551
1929–30.....	14, 314, 299	15, 021, 739	707, 440	

¹ Ended July 31.

The budget of Honduras for the fiscal year 1933–34 (beginning Aug. 1) according to the American Minister at Tegucigalpa was set by the Honduran Congress to balance at 15,222,204 lempiras (\$7,611,102 at par of exchange) distributed as contained in table 15.

TABLE 15.—Budget for 1933–34

Receipts		Expenditures	
Source	Amount	Purpose of expenditure	Amount
	<i>Lempiras</i>		<i>Lempiras</i>
Customs.....	4, 592, 522	Government.....	1, 818, 517
Monopolies.....	1, 903, 700	Justice.....	318, 140
Stamp taxes.....	1, 599, 742	Public health.....	185, 904
Public services.....	2, 119, 770	Foreign relations.....	569, 487
Special sources.....	3, 929, 014	Education.....	1, 987, 431
Miscellaneous sources.....	1, 077, 456	Development of Labor and Agriculture.....	3, 777, 094
		Defense.....	1, 579, 730
		Treasury.....	1, 193, 394
		Public credit.....	3, 772, 507
Total.....	15, 222, 204	Total.....	15, 222, 204

By Executive Decree No. 3 the sum of 2,743,285 lempiras was lopped off the appropriation, it being evident to the Minister of Finance that the receipts would not be such as were anticipated by the Congress. The principal items so reduced were certain public works and road construction, totaling about 1,240,000 lempiras, and a reduction of 1,353,590 lempiras in public-debt service. Reductions brought the budget to 12,478,918 lempiras. With certain exceptions, amounting to 3,720,734 lempiras, the budget was then subjected to a flat 20 percent reduction, bringing it

down to 10,727,282 lempiras, or about the receipts expected by the Minister of Hacienda for the ensuing fiscal year.

Public debt.—According to the finance division of the Department of Commerce, the public debt of Honduras as of July 31, 1932, comprised the following, in lempiras:

External debt.....	9,386,964
Internal debt.....	10,739,642
Floating debt.....	6,834,897
Total.....	26,961,503

In dollars at par of exchange this would amount to \$13,480,752. The internal debt does not include bonds drawn but not paid.

American investments in Honduras.—American investments in Honduras at the end of 1930 totaled approximately \$71,735,000, practically all of which was in the form of direct investments. Of this amount \$26,086,000 was invested in communication and transportation; \$5,661,000 in mining and smelting; and the balance, \$39,998,000, in miscellaneous enterprises. A large part of the latter figure represents the investments of the various fruit companies.

Some of the American firms with important investments in Honduras are:

1. The United Fruit Co., which with its various subsidiaries, has over \$25,000,000 invested in lands, plantations, buildings, railway lines, docks, etc. This company owns about 163,000 acres, of which 74,000 are under cultivation.

2. The Cuyamel Fruit Co., recently absorbed by the United Fruit Co., but still operating in Honduras under its own name and under the name of its subsidiary, the Cortes Development Co., also has large investments in lands, banana and sugar plantations, buildings, sugar mill and equipment, railways, etc.

3. Standard Fruit & Steamship Co., with its subsidiary, Vacarro & Co., owns lands, fruit and sugar plantations, railways, buildings, etc.

4. New York & Honduras Rosario Mining Co. operates gold and silver mines and has about \$4,000,000 invested in Honduras.

5. The West End Opoteca Mines Co. owns about 1,500 acres in Honduras, including the Opoteca silver mines.

6. The America & Honduras Mines Co. owns gold and silver mines and farm and timber lands.

7. The Copper Consolidated, Inc., owns 12,355 acres, containing copper mines.

8. Antigua Gold & Copper Co. owns gold and copper mines.

9. Central American Petroleum Co. has a concession for 4,000,000 acres, and has prospected for oil.

10. The Honduras Petroleum Co. has prospected for oil in four States.

11. The national railways of Honduras have been under the management of American interests, represented by the Cia. Agricola de Sula.

12. American Chicle Co. owns large tracts of chicle-producing lands.

13. Tropical Timber Co. owns timberlands, saw-mills, etc.

British interests have invested about \$6,000,000 in Honduras, chiefly in the form of government bonds; other foreign nationals have invested about \$1,000,000 in various enterprises.

TECHNICAL SECTION

The proposed route.—The termini of the Honduras section of the inter-American highway are the crossings of the Rio Negro just below the mouth of the Rio Guasaule near La Canoa, and the Goascoran at Santa Clara. The Rio Negro marks the boundary between Honduras and Nicaragua, and the Rio Goascoran that between Honduras and El Salvador.

The proposed route affords connection at San Lorenzo with ocean and coastwise vessels. Ocean steamers do not call at San Lorenzo, the nearest port for them being Amapala, but the freight unloaded at Amapala is brought to the mainland at San Lorenzo on barges and distributed from there throughout the interior of the Republic.

Also at San Lorenzo connection is made with the Pan American system of airways.

There are no railroads on the west coast of Honduras.

Junctions are made at Las Lajas, with trails and cart roads leading into the surrounding country; at Namasique, with trails and cart roads radiating toward the mountains and the seacoast; at Pavana, with trails; at San Lorenzo, with a highway known as the highway of the south that leads from San Lorenzo to Tegucigalpa, capital of the Republic; at Nacaome, with trails and cart roads; and at Alianza, with trails and cart roads.

There were two routes considered for the Honduran section of the inter-American highway:

1. Entering Honduras by Los Manos on the Nicaraguan boundary line, thence passing through the towns and cities of Danli, Tegucigalpa, Comayagua, Siguatepeque, La Esperanza, and Gracias to the El Salvador line near the town of Ocotepeque in the extreme western section of Honduras.

2. Entering Honduras from Nicaragua at a point near the hacienda Las Lajas, thence passing through the towns of Namasique, Choluteca, Pavana, San Lorenzo, and Nacaome to the El Salvador frontier near the village of Goascoran on the Rio Goascoran.

It was brought out during the discussion of the two routes that the Honduran officials felt the inter-American highway should ultimately pass through the capital of their Republic. This desire is satisfied by route 1 but not by route 2. However, route 1 would involve difficult mountain construction throughout

practically its entire length, estimated to be 312.5 miles (500 kilometers), of which about 250 miles (400 kilometers) are at present undeveloped and not open to traffic, while route 2 consists of only 87.4 miles (140.6 kilometers) of easily constructed road, of which 7.5 miles (12 kilometers) are graded and surfaced. It was thought more practicable for Honduras to construct at present along route 2 and to include in the estimates the improvement of the highway of the south. In the future it may be possible to put route 1 in a condition serviceable for through and local traffic.

Route 2 would give Honduras, in the near future, the benefits to be derived from highway communication with her neighbor Republics, El Salvador and Nicaragua, and also those to be derived from through traffic on the inter-American highway as soon as the other Republics open their sections.

Should route 1 be adopted at present, it would probably be a great many years before Honduras could have road connection with the neighboring Republics or with the other Republics along the route.

The selected route has no principal terminal settlements in Honduras. It begins at the Rio Negro, the boundary between Nicaragua and Honduras, and ends at the Rio Goascoran, the boundary between El Salvador and Honduras.

This report and the estimates contemplate the use of the highway of the south from San Lorenzo to Tegucigalpa as a connection between the interior of the Republic and the inter-American highway.

The estimate for type 1 road does not provide for any work on this highway as it is already traversable the year round. The estimates for types 2 and 3 contemplate bringing this section of highway to the same standards as those of the inter-American highway. In this way the capital city of the Republic will be served as well, if not better, than if the inter-American highway were routed over alternate route 1 and there will be far less construction work to be done.

Control points.—The recommended route of the Honduras section of the inter-American highway crosses the Rio Negro (Nicaragua-Honduras boundary) near the La Canoa bridge site, passes along the foothills to the north of the Haciendas Las Lajas and San Bernardo; through the towns of Namasique, Choluteca, Pavana, and San Lorenzo to Jicaro Galan, a point on the highway of the south; and along the foothills, through the town of Nacaome to the Santa Clara bridge site on the Rio Goascoran (Honduras-El Salvador boundary).

The control points decided upon after a field inspection, reconnaissance, and conference with the road officials of Honduras, El Salvador, and Nicaragua are:

1. Crossing of the Rio Negro near La Canoa, about one-third to two-thirds mile (one-half to 1 kilometer) north of Paso Gallegos (the proposed crossing for the Intercontinental Railway).

2. About two-thirds mile (1 kilometer) to the northwest of the Hacienda Las Lajas.
3. A point near the Hacienda San Bernardo.
4. Town of Namasique.
5. Town of Choluteca.
6. Village of Pavana.
7. Town of San Lorenzo.
8. Jicaro Galan, on the highway of the south, approximately 8 miles (13 kilometers) north of San Lorenzo.
9. The town of Nacaome.
10. The crossing of the Rio Goascoran at the Santa Clara bridge site.

Consideration was given to a direct route from Pavana to Jicaro Galan which does not pass through San Lorenzo. There is little difference between this route and the one selected so far as cost, distance, etc., are concerned. It would, however, shorten by 8 miles (13 kilometers) the distance between points along the inter-American highway and points in the interior of Honduras along or reached by the highway from San Lorenzo to Tegucigalpa and the interior. The selected route has the advantage of touching directly the port of San Lorenzo, which seemed to be the desire of the Honduran officials.

Consideration was also given to an alternate location of route 1 between Pavana and Nacaome which would cross the highway from San Lorenzo to Tegucigalpa about 3 miles (5 kilometers) north of San Lorenzo, and would pass in close proximity to the Pan American Airways landing field. This route would pass partially through and partially south of the mountains that lie to the north and east of San Lorenzo and eliminate a gap in the mountains to the southwest of Nacaome.

The objectionable features to this route are that it crosses two summits between Nacaome and Pavana, causes bad general alinement near Nacaome, and crosses the Tegucigalpa road 5 miles (8 kilometers) further from Tegucigalpa than does route 1. The only arguments in its favor are the facts that it passes the landing field of the Pan American Airways and crosses the highway of the south 5 miles (8 kilometers) nearer San Lorenzo than does route 1. It is not believed, considering the above facts, that the alternate route should be adopted.

Control point 1, the crossing of the Rio Negro near La Canoa, is tentatively selected as the site for an international bridge between Honduras and Nicaragua. It lies between Palo Grande and the confluence of the Rio Negro and the Rio Guasaule, and is about one-third mile (one-half kilometer) upstream from Paso Gallegos. The river at this point flows comparatively straight, has high banks containing large lava boulders on the Honduran side, while the banks on the Nicaraguan side appear to be approximately 16 feet (5 meters) above the high-water elevation and consist of rock

strata overlain with 6 to 10 feet (2 to 3 meters) of earth. The waterway is well confined, the stream comparatively deep, and a span of about 450 feet (136 meters) will be required.

Other sites were investigated. One known as La Colorada is about one-third mile (one-half kilometer) upstream from Palo Grande. At this point large boulders are found in the stream bed about 33 feet (10 meters) from the Nicaraguan shore, which itself is a rock shelf jutting out prominently into the stream. The curve of the river here is unfavorable to a bridge location and much clearance would be required in order to make the bridge and approaches safe during high water when many trees and a great deal of debris are carried by the stream.

Another site investigated was Paso Gallegos, which is the crossing advocated by the Inter-Continental Railway Survey, but it is not well suited for a highway crossing because the approaches on either side of the stream require large and expensive embankments which are probably justified for the alinement required by railroads, but can be avoided by highways.

There were several other crossings investigated, but none of them seemed as favorable or practical as the one near La Canoa.

Controls 2 and 3, the Haciendas of Las Lajas and San Bernardo, are selected in order to fix the located line near and preferably to the upland side of these places.

Namasique is selected on account of its strategic position, lying as it does almost in a controlling gap in the mountains, and being a village of some importance.

Choluteca, with a population of 12,000, is selected because it is the largest and most important town in the section of Honduras traversed by the highway. The bridge site for the crossing of the Rio Choluteca is at this point and has already been surveyed by the Honduran engineers. It was examined and found to be suitable for a bridge of about 600 feet (180 meters). On the shore bordering the town was found a lava and boulder bluff and on the opposite shore was a gradually sloping sand flat which is covered by water in the wet season. The channel of the stream is at right angles to the axis of the proposed bridge and is straight for some distance both up and down stream from the site. The waterway is about 82 feet (25 meters) in width during dry season.

Pavana is selected for the reason that it is at the northeastern end of the section of the highway that has been located and partly constructed and is a settlement of some importance.

San Lorenzo was chosen to make direct contact with a principal point of entry and to comply with the desires of the Honduran officials as stated above.

Jicaro Galan is considered a control point for the reason that it establishes the approximate point where

inter-American highway leaves the national highway between Tegucigalpa and the coast.

The village of Nacaome, having a population of 8,200, the only other large place in the region, is considered important as a control point, and the Rio Nacaome, which will require a span of about 660 feet (200 meters), should be crossed in the vicinity of this town, but below the confluence of its two branches which occurs about one-third of a mile (one-half kilometer) upstream from the town.

The last control is Santa Clara which is the site for an international bridge over the Rio Goascoran, suitable for the construction of a bridge of approximately 650 feet (197 meters) in length. The location is easily adaptable to the projected alinement of the section of the inter-American highway in El Salvador and is readily approached from Honduras.

Two other proposed crossings were investigated, namely, Los Horcones downstream from Santa Clara, and Los Encuentros about two-thirds of a mile (1 kilometer) upstream from the village of Goascoran, which also is upstream from Santa Clara. The Los Horcones crossing was not considered good on account of its low banks, requiring expensive approaches in order to avoid danger from floods, and the Los Encuentros site was discarded on account of the long span necessary and the difficult approaches for the road, both from El Salvador and Honduras. It had the useful feature of a solid rock island in the stream, but this was not considered of enough importance to over-balance the disadvantages.

Running description.—The route through Honduras is entirely within the Provinces of Valle and Choluteca, which lie in the extreme southern portion of the Republic. This section offers the shortest and most practical route between Nicaragua and El Salvador. The northernmost sections of these Departments consist of numerous mountain ranges and peaks that fall away as they approach the Pacific Ocean (Gulf of Fonseca) which is bordered by a broad, low, coastal plain fringed with expansive mangrove swamps intersected by shallow tidal channels. Some of these are prolongations of river channels, and are navigable for boats of from 4 to 6 foot (1 to 2 meters) draft, while others are simply inlets broadening out at various places into shallow lagoons. All of them, regardless of size or depth, may properly be called estuaries or "esteros." Along these and contiguous to the coastal plains are numerous tide-covered areas known locally as salt flats, which are free from mangrove growth or other vegetation.

The Gulf of Fonseca, which forms the Pacific coastal section of Honduras, receives all the drainage from the mountains to the north and east and is one of the best natural harbors along the Pacific coast, its advantages being shared by El Salvador, Nicaragua, and Hon-

duras. Amapala is a port for ocean-going steamers and is situated on Tiger Island, Department of Valle. Through this port flows the interior trade which is distributed by small boats and barges plying the esteros which lead to the small mainland ports of San Lorenzo, El Garcero, Coyal, La Brea, and Aceituno. The first-named port is the most important and can be reached from Tegucigalpa at all seasons of the year by automobile in from 4 to 5 hours.

The Rio Choluteca flowing across the Department of Choluteca, and the Rio Nacaome across the Department of El Valle in a southwesterly direction to the Gulf of Fonseca, divide the terrain in Honduras lying between Nicaragua and El Salvador into three approximately parallel strips, all mountainous in the northern and eastern sections and flattening out into coastal plains in the southern and western sections.

The coastal plains are practically devoid of vegetation except for grass and a few varieties of scrub trees known as "acacias" and "jicaros."

The principal drainage is from the northeast to the southwest, crossing the proposed location almost at right angles. The most important streams to be considered are the Rios Negro, Choluteca, Nacaome, and Goascoran. There are numerous smaller streams, the largest of which are the Rios San Bernardo, Salto, Sanpile, Las Canas, and San Pedro. Most of these are dry at certain seasons of the year.

The soil conditions in the area skirting the foothills are excellent for road construction. The less favorable characteristics of the lowland plains may be overcome providing the grade line can be elevated sufficiently to prevent saturation of the roadbed in the wet season. The supporting power of the soil in the lowlands seems amply sufficient to carry high fills, but these are not recommended except in unavoidable locations. They would require the movement of large quantities of materials for long distances in order that the proper subgrade and surfacing materials might be had. It is recommended that the line traverse the foothills, crossing occasional ends of spurs and passing through low gaps as alinement standards permit.

Leaving the bridge site near La Canoa on the Rio Negro, the route follows a northwesterly direction, passing southwest of Los Hormigos to San Bernardo where it turns generally northward to Namasique, from where it continues northwestwardly to Choluteca.

The section of the route from the Rio Negro to Namasique traverses plains and slightly rolling foothills gradually rising to the well-defined control gap at Namasique.

From this point there is a gradual descent over broken terrain to the city of Choluteca, which lies on the Rio Choluteca.

Continuing in a northwesterly direction after crossing the Rio Choluteca at the bridge site selected, it

follows the route surveyed by the Honduran authorities over rolling and semimountainous terrain as far as Pavana.

After leaving Pavana there are broken foothills for a short distance and then the coastal plain is followed to San Lorenzo. There is ample road material throughout this section.

The highway of the south is followed through planular territory from San Lorenzo to Jicaro Galan, and from this point to Nacaome the terrain is practically level, although sloping slightly toward the Rio Nacaome.

Leaving Nacaome the direction is southwest along broken foothills to Agua Caliente, where it turns west, still following along the foothills to the head of tide-water at Estero Hermoso. From here it continues westwardly to the small port of Aceituno, and thence northwest by way of La Alianza to the Santa Clara crossing of the Rio Goascoran.

Between Estero Hermoso and La Alianza is found low-lying terrain and it may be necessary to throw the line back toward the foothills through here. However, it is well to touch the port of Aceituno if it is found practicable.

Throughout the length of the route, with the exception of a short distance near Aceituno, are found abundant road materials in close proximity to the line.

The foothills abound in a variety of materials excellent for subgrade and surfacing and the excavated materials will make not only excellent subgrades, but in many instances will be of such quality as to provide a satisfactory surface for light traffic throughout the year.

The foothills are composed principally of lava flows, but solid rock occurs in many places. While most of the rock seems to be of igneous origin, there are places where sedimentary sand and limestone occur. Limestone was particularly noted along the newly constructed road between Pavana and Choluteca.

Gravel abounds in the river beds. It is usually of large dimensions and contains only a small percentage of fine material.

Alinement.—There are only a few places along the route where it is probable that curves of minimum radii will be employed. These are in the semimountainous sections near Namasique and Pavana. A minimum radius of 300 feet (91.5 meters) should be maintained elsewhere along the route.

Direct alinement with long tangents should be used wherever feasible. However, with such practice through extremely level terrain, it is difficult to obtain a grade line sufficiently undulating for proper drainage. When this is true it seems advisable that the line be thrown into the foothills where, by properly adjusted alinement and gradients, excellent drainage will be assured.

Gradients.—There will be no difficulty in maintaining all gradients below the adopted maximum

standard throughout the Honduran section of the highway.

A minimum grade of 1 percent is recommended where the general contour of the ground is being closely followed.

Mountains.—The principal mountain ranges lie in the central part of the country and, therefore, are not touched by the route of the inter-American highway. There are irregularly shaped spurs that extend almost to the Gulf of Fonseca, but they are low in elevation and offer no particular obstacles.

There are several prominent peaks in the Gulf of Fonseca to the southwest of the route. These are of volcanic origin and lie in a direct line between the volcanoes of Nicaragua and El Salvador. None of them are active.

Valleys and principal drainage.—Practically none of the route follows along valleys. It crosses all of the streams originating in the interior mountains and emptying into the Gulf of Fonseca. The largest stream lying wholly within Honduras and crossed by the highway is the Rio Choluteca. Next in size to this is the Rio Nacaome. The Rio Negro, on the Nicaraguan border, the Rio Choluteca, the Rio Nacaome, and the Rio Goascoran, on the Salvadorean border, divide the terrain traversed by the highway into three strips of land, each of which contains smaller streams that are either tributary to one of the rivers mentioned or flow into the Gulf of Fonseca. It is evident, therefore, that drainage constitutes here a major problem as the line crosses all of the streams that originate on the western slopes of the interior mountains.

The Rios Negro, Choluteca, Nacaome, and Goascoran will require bridges of 450, 600, 660, and 650 feet, respectively.

Soil conditions.—Throughout Honduras the ground is very favorable to road construction. That on the ridges and higher elevations is solid the year round and is composed principally of old lava flows. This material will be excellent for fills across the low intervening llanos, which at present are formidable obstacles to travel during the rainy season. They can easily be crossed by a highway, however, as the soil, composed largely of disintegrated lava and volcanic dust, rests upon a solid base that will support a sufficient embankment for proper drainage.

The foothills contain ample quantities of stone of varying qualities. It is thought that no difficulty will be encountered in obtaining the requisite amounts of any grade desired. Between Choluteca and Pavana there is a very good grade of limestone.

Sand is to be found in the stream beds and is easily obtainable during the dry season.

Existing roads used.—The entire route through Honduras will be over new location except for a short section between Choluteca and Pavana where a new road is being constructed, and that part of the highway

of the south between San Lorenzo and Jicaro Galan which is proposed as a common section.

There are 5 miles (8 kilometers) of road leading out of San Lorenzo toward Pavana that have been opened and can be traveled in the dry season by automobile. The section was graded several years ago at a cost of \$8,047.17. Bridges and culverts are of wood and there is no surfacing, but in many places the natural material is fairly stable. For its entire length the road lies in flat country and is included in the inter-American highway.

The highway from Tegucigalpa to San Lorenzo, known as the highway of the south, is 81 miles (130 kilometers) long, and this highway should be considered a part of the inter-American highway to the capital city of Honduras until such time as a possible alternate route lying higher in the mountains shall be constructed. Work on it was begun in 1899 during the administration of Gen. Terencio Sierra, and it was completed in 1906 during the administration of Gen. Manuel Bonilla. The cost of grading and draining the highway was about \$1,000,000 gold, or approximately \$7,700 gold per kilometer. This, however, does not include the cost of the Mallol Bridge, which was \$74,817.50

The air line distance from Tegucigalpa to San Lorenzo is approximately 56 miles (90 kilometers). The fact that the distance along the highway is so much greater is due to a large extent to the excessive development necessary in the mountainous terrain through which the road is located. Tegucigalpa, which is the northern terminus of the highway of the south, is at an elevation of 3,200 to 3,500 feet (976 to 1,067 meters) and is situated on the Rio Choluteca, which flows to the Pacific Ocean (Gulf of Fonseca) to the south and east of San Lorenzo. This river rises in the mountains to the south and west of Tegucigalpa, flows north, gradually making a large bend toward the east, and thence turns toward the Pacific.

The highway of the south, leaving Tegucigalpa, begins to ascend the irregularly shaped ridges between the waters of the Choluteca and those of the east and west branches of the Rio Nacaome. The ridges followed by the highway form a triangle with the waters of the Choluteca, draining its base or northern side, and those of the east and west branches of the Nacaome draining the other two sides.

The highway remains on these much-broken and water-scarred ridges, continually descending their spurs, until finally it crosses an eastern branch of the Rio Nacaome near the town of Pespire. Thence it follows generally the valley of the Nacaome and the coastal plains to San Lorenzo. It makes junction with

the proposed location of the inter-American highway very near the site of a small frame building known as "Jicaro Galan", about 8 miles (13 kilometers) north of San Lorenzo. A large part of the road is side-hill location, which has necessitated very heavy excavation. The fill side in many places is supported by retaining walls, and in some places the cut slope has been stabilized by the use of sections of retaining wall. This was particularly noticeable at points where rock cuts had been made and there was danger of slides or of loose rock falling upon the road.

The highway is graded from 24 to 26 feet (7.3 to 8 meters) wide and the culverts and bridges are of hand-cut masonry. The surfacing is of rather crudely constructed macadam, varying in depth and width, and consisting of crushed rock covered or bound with finer local materials, either sand, clay, or disintegrated stone. The binding material is very difficult to hold in place on account of the excessive curvature in the road, the heavy gradients, and the alternating wet and dry seasons.

The alinement is tortuous, with many blind and dangerous curves, which can be materially improved at nominal expense. The grades are not prohibitive as the usual maximum is 8 percent, but there are short sections which reach 10 percent. The scenery is magnificent and with its long vistas over the mountains offers much to attract the traveler.

The largest towns along the highway of the south are El Sauce, Sabana Grande, La Venta, San Antonio de Flores, and Pespire, all of which are typically Honduran in their setting and construction.

In table 16 are shown the total amounts that have been expended on the highway of the south over a period of years for various purposes.

TABLE 16.—Cost data on the highway of the south¹

Item	Total	Average cost per kilometer	Average cost per kilometer per year
Grading and draining (\$1,000,000)-----	\$1,074,817.50	\$8,267.82	-----
Mallol Bridge (\$74,817.50)-----			
Macadamizing-----	769,959.50	5,922.76	-----
Maintenance prior to paving 1907-11-----	91,332.00	702.55	\$175.64
Maintenance since paving 1921-29-----	163,032.90	1,254.10	156.76

¹ Total length, 81 miles (130 kilometers).

Estimates of cost.—Tables 17, 18, and 19 itemize the estimated costs on the principal phases of the operations in Honduras.

The total length of the proposed highway in Honduras is 87.4 miles (140.6 kilometers).

All bridges are figured for a 20-foot roadway. Those in place on the road from San Lorenzo to Tegucigalpa are to be widened or rebuilt.

One-half of the cost of bridging the Rio Negro between Nicaragua and Honduras and the Rio Goascoran between El Salvador and Honduras is included in the estimates for all types.

No provision has been made for materially reducing the grades on the San Lorenzo-Tegucigalpa section as this would involve practically a new location and it is not thought that the grades are excessive enough to warrant this expenditure.

Estimates for type 1, table 17, contemplate an all-weather graded section 28 feet wide with a surfacing of local material 18 feet wide and 6 inches thick compacted, over a total distance of 83.3 miles of road.

Estimates for type 2, table 18, contemplate an oil treatment over the type 1 road. In addition they provide for resurfacing and oiling 81.25 miles of road from San Lorenzo to Tegucigalpa and for oiling 4.1 miles of road already constructed on the route, a total mileage of 168.65.

Estimates for type 3, table 19, contemplate a concrete pavement 20 feet wide and 8 inches thick and a 32-foot graded section, over a total distance of 168.65 miles of road.

Principal stream crossings in Honduras are shown in table 20 and the length of span is indicated for bridges not yet constructed.

TABLE 17.—*Estimates for type 1*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	75	Miles.....	\$350.00	\$26,250.00
Unclassified excavation.....	850,000	Cubic yards.....	.75	637,500.00
Small drains.....	57,400	Linear feet.....	7.00	401,800.00
Bridges.....	3,075	do.....	150.00	461,250.00
Surfacing.....	195,500	Cubic yards.....	2.50	488,750.00
Total.....				2,015,550.00
Add 12½ percent for engineering and contingency.				251,943.75
Total estimate.....				2,267,493.75

TABLE 18.—*Estimates for type 2*

Item	Quantity	Unit	Unit cost	Amount
Oil.....	890,472	Gallons.....	\$0.25	\$222,618.00
Surfacing.....	95,306	Cubic yards.....	2.50	238,265.00
Type 1, all items.....				2,015,550.00
Total.....				2,476,433.00
Add 12½ percent for engineering and contingency.				309,554.12
Total estimate.....				2,785,987.12

TABLE 19.—*Estimates for type 3*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	75	Miles.....	\$350.00	\$26,250
Unclassified excavation.....	1,373,000	Cubic yards.....	.75	1,029,750
Small drains.....	71,750	Linear feet.....	7.00	502,250
Bridges.....	4,500	do.....	150.00	675,000
Surfacing.....	439,670	Cubic yards.....	15.00	6,595,050
Total.....				8,828,300
Add 10 percent for engineering and contingency.				882,830
Total estimate.....				9,711,130

TABLE 20.—*Principal stream crossings*

Name of stream	Length of bridge span	
	Feet	Meters
Rio Negro (one-half the total length).....	225	68
Quebrada (kilometer 1,519).....	50	15
Quebrada (kilometer 1,523).....	80	24
Rio San Bernardo.....	100	30
Rio Salto.....	100	30
Rio Sanpile.....	100	30
Rio Choluteca.....	600	183
Quebrada (kilometer 1,558).....	80	24
Quebrada (kilometer 1,562).....	60	18
Rio Augua Caliente.....	100	30
Rio Laure.....	100	30
Rio La Criva.....	70	21
Rio El Comercia.....	100	30
Rio Nacaome.....	660	201
Rio Las Canas.....	100	30
Estero Hermoso.....	100	30
Rio San Pedro.....	125	38
Rio Goascoran (one-half the length).....	325	99
Total.....	3,075	931



PLATE 38.

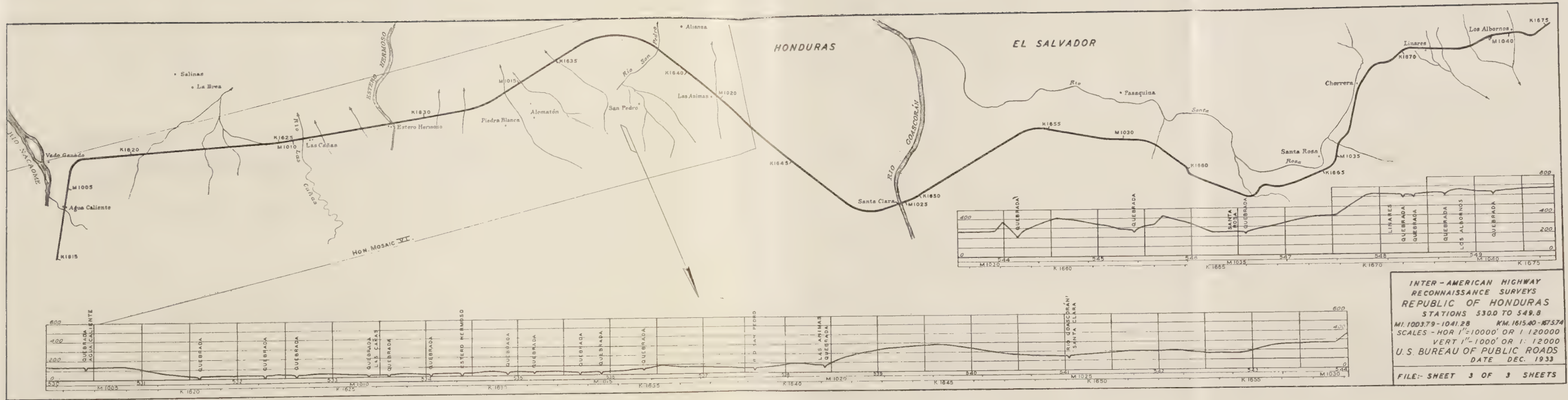


PLATE 38.

PROPOSED INTER-AMERICAN HIGHWAY

REPORT OF A RECONNAISSANCE SURVEY FOR THE
PROPOSED INTER-AMERICAN HIGHWAY

PART VI.—REPUBLIC OF EL SALVADOR

BUREAU OF PUBLIC ROADS
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.



EL SALVADOR

GENERAL SECTION

HISTORY

El Salvador was invaded by Pedro de Alvarado, coming from Mexico by way of Guatemala, in 1524. The city of San Salvador was founded in 1528 and removed to its present site in 1539. For 3 centuries El Salvador was a part of the vice royalty of Guatemala. After Mexico achieved its independence of Spain under Augustin de Iturbide that leader was, on May 18, 1822, proclaimed Augustin I, Emperor of Mexico, and in September his empire was extended from the forty-second parallel of north latitude to the Isthmus of Panama. Iturbide was deposed April 7, 1823. In June 1823 General Filisola, commanding the Mexican Army in Central America, summoned delegates to an assembly which met at Guatemala City. This assembly announced that the Provinces of the former captaincy-general of Guatemala were free and independent states and had confederated into the United Provinces of Central America. They were so recognized by Mexico August 20, 1823. El Salvador was an associate of this federation, which disintegrated in 1839. In 1841 it adopted a constitution vesting governmental authority in a president and a bicameral legislature. A second constitution was adopted in 1864, a third in 1871, and a fourth about 1876. The last constitution, that of 1886, is still the fundamental law of the country. The Republic was recognized by Spain in 1865.

El Salvador joined in the 1842 attempt at Chinandega, Nicaragua, to create a Central American Confederation, but following a meeting of delegates to the Constituent Congress in Leon, Nicaragua, in 1849, the Salvadoran Assembly declined to ratify the action of the Congress. A conflict between El Salvador and Guatemala in 1863 disrupted this federation. The Salvadoran Constitution of 1886 declared that El Salvador's right to form a compact of union with other states of Central America remained unimpaired.

El Salvador was a signatory to the Amapala Agreement of 1895 to establish the Greater Republic of Central America, which collapsed in 1899. El Salvador signed the Treaty of Union at San Jose, Costa Rica, in 1921, providing for a Federation of Central America, and its assembly ratified that treaty.

GEOGRAPHY, TOPOGRAPHY, AND AREA

El Salvador is the smallest of the Central American republics, with an approximate area of 13,176 square miles (about 34,000 square kilometers). It is the only republic in the group that does not touch both the Atlantic and Pacific Oceans.

It is bounded on the north by Guatemala, on the east by Honduras and the Gulf of Fonseca, on the south by the Pacific Ocean, and on the west by Guatemala.

The volcanic range which approximately parallels the Pacific coast passes through the country. The principal volcanoes are San Miguel, Coatepeque, and San Salvador. Of these only San Miguel shows any signs of activity.

The country is hilly in general, but there are no particularly high mountains or well-defined ridges. The Rio Lempa is the largest stream, and it flows across the entire country from northeast to southwest.

Climate and rainfall.—The temperature of El Salvador is typical of tropical countries. Along the coast the days are exceedingly hot, but some relief is afforded by nightfall. The interior is also very warm except at the higher altitudes, where it is pleasant both day and night for the entire year. Maximum and minimum temperatures average 85° and 50° F., respectively.

The year is divided into two seasons, the wet and the dry, the former extending from June to December, inclusive, and the latter over the remaining months. The rainfall varies from approximately 60 inches (150 centimeters) per year along the coast to 50 inches (120 centimeters) in the interior. Practically no rain falls during the dry season.

Population.—The Statistical Annual of El Salvador for 1930 gives a population by Departments of 1,459,578 and states that "the number of inhabitants relates to December 31, 1930." The distribution given by the Annual is shown in table 1.

Of this total it is estimated that about 70 percent may be regarded as rural. No data are available showing the number of people engaged in agriculture, mining, and manufacturing, but El Salvador statistics indicate that nearly 3,500 are engaged in coffee-growing and 43,500 in stock-raising, the great majority of the latter being owners of small flocks.

TABLE 1.—*Distribution of population by departments in 1930*

Department:	
Santa Ana.....	156, 926
Ahuachapan.....	80, 820
Sonsonate.....	102, 430
La Libertad.....	120, 615
San Salvador.....	193, 132
Chalatenango.....	83, 990
Cuscatlan.....	84, 740
La Paz.....	89, 422
San Vicente.....	78, 827
Cabanas.....	59, 895
San Miguel.....	130, 354
Usulután.....	126, 884
Morazan.....	76, 540
La Unión.....	75, 003
Total.....	1, 459, 578

ECONOMIC SECTION

National wealth.—By analogy with values and conditions in other Central American countries an attempt to gage the national wealth of El Salvador is hazarded. Due to the fact that cultivated lands are relatively high in El Salvador we might give an average value of \$30 an acre to the 5,000,000 cultivated acres, or \$150,000,000. Probably \$2 an acre would be a fair average for the estimated 500,000 acres of cultivable lands, the greater part of which are located in the Departments of Morazan and La Unión. Allowing 500,000 acres for city and town sites, the remaining 2,500,000 could be dismissed with a valuation of 20 cents an acre, as possible eventually of being capable of some economic utilization. This would give a total value in lands of \$151,500,000. There is no way of arriving at an estimate of the value of timber and minerals. Salvadorean cattle are comparable with those of Costa Rica at \$14 a head. Let us gross the value of all livestock at \$4,500,000. No data are at hand from which to estimate the value of banks, railways, urban property, and assets of the Government.

It is the observation of travelers in Central America that the standard of living of citizens of the middle class in El Salvador is on a plane with that of the same class in Costa Rica, although the population density is greater in the smaller country.

It has been estimated that 60 percent of El Salvador's area is under cultivation and it is fair to assume, then, that at least 20 percent of the population is engaged in gainful occupations, or roughly 300,000 persons. Wages and emoluments generally are somewhat higher in Nicaragua, where Cumberland places them at an average of \$200, than in El Salvador. If we take \$180 as the average annual income of 20 percent of the Salvadorean population we will thus have an aggregate annual income of approximately \$54,000,000. This includes monetary income and the value of commodities produced and consumed in the country without entering into commercial transactions. On the basis of the accepted normal ratio of national income to national

wealth (25 percent), this would indicate that the latter is for El Salvador somewhere in the neighborhood of \$220,000,000 which is not believed to be unreasonable.

The external funded debt is about \$19,000,000, leaving a net wealth for El Salvador of \$201,000,000, or a per capita of \$138.

Foreign investments other than the public debt total something like \$37,000,000. This would leave a net wealth for the Salvadorean people proper of approximately \$164,000,000, or \$112 per capita.

Employment and wages.—Normally current wages in El Salvador, as indicated by a report from American Consul A. E. Carleton, San Salvador, October 28, 1931, range from a minimum of 50 centavos for common labor and 60 to 75 centavos for coffee pickers, to 2.50 and 3 colones a day for the skilled trades. At par a Salvadorean colon is equal to 50 cents and a centavo is equal to one-half a cent, United States currency.

The 8-hour rule obtains more in the cities than on plantations, where 9 and 10 hours work per day are not uncommon. Overtime is paid at the rate of one and one-half times the regular hours. Traveling to and from work for day laborers is included in the regular hours.

It is not customary to give family allowances in cash, but men with families are given housing, firewood, land to plant cereals, and medicines. These families become permanent workers on the coffee plantations. Almost without exception all property owners give the workers food in addition to the cash wage. Except for the higher grades of employees the food consists of tortillas (corn cakes) and black beans three times a day and coffee once or twice a day.

PRODUCTS AND INDUSTRIES

AGRICULTURE

Coffee.—On the authority of the American fiscal agent in San Salvador there are approximately 30 big coffee estates in the country, the largest of which yields to its owners something like 25,000 quintals of coffee annually. (A quintal equals 101.43 pounds.) There are two or three capable of producing 20,000 quintals, perhaps half a dozen of from 12,000 to 15,000 quintals, and 15 or 20 of 5,000 to 10,000 quintals. The remaining coffee acreage is pretty well split up into small holdings. A fairly recent survey made by Engineer Roberto Lopez Harrison, of El Salvador, shows that 90,400 hectares, or about 226,000 acres, of coffee-bearing land are divided among 3,450 growers, or an average of a trifle over 65 acres per grower. It is probably safe to say that approximately 25 percent of the coffee is produced on the large and 75 percent on the small fincas.

The large fincas are as a rule well equipped with transportation facilities and so located as to be able easily to reach shipping points. The owners of small

fincas frequently lack capital to build service connections to a main highway and lack of an adequate road system bears more heavily on them. The proposed inter-American highway would directly benefit many of these small fincas and lateral roads which are almost certain to follow would be a great boon to the small grower. Thus the proceeds of the "money crop" of El Salvador would be more evenly distributed.

The Statistical Annual of El Salvador for 1929 states that the 1928-29 crop of coffee was over 60,000,000 kilos, or about 132,000,000 pounds, and that this was 11.5 percent below that of the previous year. This would indicate a relatively heavy yield of between 600 and 630 pounds per acre as compared with other Central American countries. According to the Commerce Yearbook, 1932 (U.S. Department of Commerce), 1930 production reached 165,000,000 pounds, but there was a heavy fall in price.

El Salvador ranks fourth among the coffee-producing countries of the world and ships nearly 38 percent of all coffee exported from Central America. According to a graph prepared by the statistical section of the Bureau of Foreign and Domestic Commerce, over 44 percent of the coffee is grown in the department of Santa Ana, 16 percent is grown in La Libertad, 11 percent in Ahuachapan, and nearly 10 percent in Usulután. While production figures over a period of years are not available, an idea of the importance of coffee to El Salvador can be obtained from the following table of exports.

TABLE 2.—Coffee exportation by amount and value in recent years

Year	Amount (tons)	Value
1913.....	28,452	\$7,907,000
1920.....	37,587	12,404,000
1923.....	41,994	14,698,000
1925.....	32,064	15,181,000
1926.....	50,640	23,360,000
1927.....	36,210	12,619,000
1928.....	53,109	22,741,000
1929.....	46,783	17,045,000
1930.....	58,638	11,957,000
1931.....	54,646	10,587,000
1932.....		6,279,133

Germany takes about one-third of the coffee exported from El Salvador, while about 14 percent is shipped to the United States.

Next to coffee in agricultural importance comes corn, following which, in the order named, are cattle, beans, sugar, rice, henequen, and cotton.³

The only production figures available by territorial departments are those shown in a blue print graph prepared by Engineer Roberto Lopez Harrison, from which the figures shown in table 3 were compiled.

³ Mr. Frank V. Dunham, representing the New Orleans Chamber of Commerce, in a market survey made in May 1931 says: "It is estimated that at least 82 percent are Indians whose chief articles of sustenance are almost entirely corn, beans, and rice, and native fruits, and such vegetables as are locally grown."

TABLE 3.—Production of major crops by Departments in 1929

Department	Coffee ¹		Corn ²		Sugar ³		Cattle ⁴	
	Acres	Quintals	Acres	Quintals	Acres	Quintals	Raisers	Head
Santa Ana.....	60,000	620,000	28,000	414,000		30,000	2,297	29,500
Ahuachapan.....	27,500	160,000	10,000	144,000		29,000	1,594	13,000
Sonsonate.....	30,000	70,000	29,000	447,000		130,000	1,808	31,000
La Libertad.....	40,000	220,000	39,000	562,000		150,000	2,223	51,000
San Salvador.....	5,000	30,000	38,000	393,000		149,000	2,468	14,000
Chalatenango.....	500	2,500	11,000	155,000		6,000	4,905	21,000
Cuscatlan.....	2,500	13,000	10,000	146,000		65,000	2,311	20,500
La Paz.....	10,000	40,000	25,000	404,000	(⁵)	18,000	3,935	16,500
San Vicente.....	2,500	12,500	25,000	501,000		85,000	3,417	18,000
Cabanas.....	2,500	11,500	8,000	107,000		18,000	3,219	11,500
San Miguel.....	12,500	75,000	46,000	702,000		58,000	4,603	41,000
Usulután.....	30,000	140,000	39,000	624,000		25,000	3,566	25,500
Morazan.....	2,500	7,500	13,000	178,000		18,000	3,578	16,000
La Unión.....	500	2,500	13,000	176,000		19,000	3,560	21,500
Total.....	226,000	1,404,500	334,000	4,953,000	-----	800,000	43,484	330,000

¹ Average yield, 621 pounds per acre. The 1930-31 yield was 1,435,000 quintals; 3,450 growers.

² There are 2 corn crops annually: The winter crop, harvested after July, accounts for 80 percent of the annual yield.

³ The graph on sugar does not correspond well with statistics later cited.

⁴ It has been estimated that the country's capacity is not less than 700,000 head.

⁵ No data.

Sugar.—Sugar is the second "money crop" of El Salvador. Annual production of refined sugar has reached 45,000,000 pounds, but it declined to 30,000,000 pounds in the 1931-32 crop year and for the 1932-33 season it was not expected to exceed 20,000,000 pounds. According to the statistical bureau, sugar, like coffee and corn, is grown in all Departments of El Salvador, the leading provinces being La Libertad with almost 19 percent of the total production, San Salvador with over 18 percent, Sonsonate with 16 percent, and San Vicente with nearly 11 percent. A quota control of sugar production was instituted in 1931, but proved unsuccessful, and in December 1932 steps were taken again to place the industry on a limited production basis through the establishment of a supervising board to fix annual quotas and maximum local prices and to make arrangements for the disposal of surpluses on hand. Earlier in the year a plan had been advanced to aid the industry by the erection of a central plant for the manufacture of alcohol from sugarcane and a concession was granted by the Government for this purpose. Exports of sugar during recent years have been as shown in table 4.

Two-thirds of the sugar exported from El Salvador was destined to the United States until 1930-31, when such exports were discontinued owing to unprofitable prices. The Department of Commerce Yearbook for 1932 gives a sugar production for El Salvador of 75,237,000 pounds in 1930, but this includes panela.

TABLE 4.—Sugar exports by amount and value in recent years

Year	Amount	Value
	Pounds	
1913.....	1,846,000	\$77,000
1920.....	13,491,000	1,104,000
1923.....	20,282,000	1,753,000
1925.....	4,904,000	203,000
1928.....	21,428,000	1,234,000
1929.....	14,813,000	907,000
1930.....	12,703,000	773,000
1931.....	1,213,000	42,000

Corn.—More land is devoted to the cultivation of corn than to coffee and its annual quantity production amounts to about three and one-half times that of the latter product. Corn takes second place in agricultural importance in El Salvador. This grain forms the "staff of life" of the vast majority of the inhabitants of the country and over 90 percent of the total production is consumed domestically. It is estimated that the annual per capita consumption is more than 300 pounds. During 1930 the domestic price of corn per hundred pounds ranged from \$1.65 to \$2.16, averaging \$1.83 for the year. According to the statistical section of the Bureau of Foreign and Domestic Commerce, 14 percent of the corn is grown in the department of San Miguel, 13 percent in Usulután, 11 percent in La Libertad, and a little over 10 percent in San Vicente. El Salvador was obliged to import corn in 1933, climatic conditions causing a short crop.

Rice.—It is extremely difficult to obtain definite information relative to the acreage planted to rice or the production of this crop in El Salvador as it is regarded as a pin-money crop and so far as is known there are no large rice growers in the country. Rice is raised by agricultural laborers on small plots of 1 to 5 acres; frequently on land belonging to the large holders, and what is not consumed by the growers and their families is taken to the crossroads stores in small parcels and used for barter. There it is pooled and forwarded through the channels of domestic trade. In a report from the American consul in San Salvador, dated June 15, 1932, an estimate of 25,000 acres was placed on the combined rice areas, giving a production of about 20,000 metric tons. The price of rice averaged \$4.90 per hundred pounds in 1930 compared with \$12.33 in 1926 and \$16.16 in 1927.

Beans.—These are also important in the Salvadoran dietary. The only data on acreage is the statement in the statistical annual for 1929:

There are two crops of corn and beans, depending on the soil. The winter crop is the more abundant. * * *. The winter crop of beans was 54,999 quintals, and the area planted 3,901 hectares.

This indicates a probable total crop of beans for summer and winter of 8,400,000 pounds.⁴ There is some importation, chiefly from Nicaragua. Prices for beans in 1930 ranged from \$4 a hundred pounds in November to \$6.66 in June, with an average for the year of \$5.73.

Henequen.—The cultivation of henequen is increasing in importance in El Salvador and in 1931 this product occupied second place among the exports from that country. It is reported that some 5,000 acres, distributed among the larger plantations, are now being cultivated by machinery. The director

of statistics of El Salvador recently called attention to the possibilities of increasing the production of henequen through its cultivation in mineral and arid zones. Production figures for 1931 show estimates of slightly more than 2,000,000 pounds. The growth of the industry is shown in table 5.

TABLE 5.—Henequen exports by amount and value in recent years

Year	Amount (tons)	Value
1913	23	\$4,000
1920	259	59,000
1923	549	77,000
1925	706	46,000
1928	878	175,000
1929	999	199,000
1930	913	196,000
1931	623	158,000

Cotton.—Climatic and soil conditions in El Salvador are favorable for the production of cotton and at one time this bade fair to become a profitable industry in the country. Insufficient precautions were taken with respect to imported slips, however, and the cotton plant became a prey to the bollweevil. At the present time it is doubtful whether more than a half score planters are engaged in cotton growing. The peak year of cotton production was 1925 when 2,298 tons, valued at \$1,115,000, were exported, chiefly to Germany and Great Britain. There has been a steady decline in production since that year and in 1931 only about 52 tons were exported. Local consumption, principally for mattress making, does not exceed 15,000 pounds annually.

There are a number of truck crops grown for domestic production and some tobacco is raised for domestic use, but there are no accurate data available concerning them.

Potential cultivation.—Expressed in acres the area of El Salvador is slightly less than 8,500,000. Of this area the director of statistics estimates about 60 percent or, say, 5,000,000 acres, is under cultivation.

The most fertile and well populated portion of the country is the valley of the Rio Lempa, which extends from the Pacific Ocean northward and somewhat eastward entirely across the country to the Honduran border. The river is said to be navigable for small boats entirely across the country to the confluence of the Rio Tonola.

Agriculture is seasonal and cultivation of crops is limited to the rainy season. Most crops mature at the beginning of the dry season. Vegetation becomes parched at this time and even many grasses dry up so as to be unfit for forage. Wheat, rye, and barley can be grown on the highlands, but they do not figure in official reports. Sugarcane, cotton, and some cacao are raised on the lowlands.

El Salvador has much fertile soil on the plateaus, in the valleys, and on the hill slopes. The statistical bureau calls attention to the fact that—

⁴ Considering the per capita consumption of beans in Guatemala (estimated at 45 pounds a year) this figure seems far too low, but there is very little information on the subject other than that quoted.

The uncultivated portion exists only on the coastal plain. Hardly any uncultivated lands are found in the interior. Nearly all of the Departments of La Union and Morazan extending to the Gulf of Fonseca are available for agricultural development, those lands being fertile and cheap.

There are also some lands capable of agricultural utilization in the so-called "mineral zones" hereinafter briefly described. In the arid portions of these zones the maguey plant thrives. Possibly 600,000 additional acres are capable of some economic utilization.

Timber resources.—Little data exist under this heading. The forests are tropical in character and in them dye woods, mahogany, rosewood, cedar, and other valuable trees are found, but apparently no estimate or cruise has been published showing location and amount further than the bare statement of the director of statistics that—

There still exist a few woodlands under development in the country, principally in the coastal zone, exporting every year regular quantities of valuable woods, principally mora logs.

In 1929 El Salvador's wood exports consisted of 60,782 kilos of wood to France, valued at \$2,895, while in 1930 exports totaled but 4,058 kilos, valued at \$287, of which 80 percent went to the United States. The French export was probably mora and dyewood although kinds are not specified. There is some native wood used locally for furniture making and construction. Probably an investigation of resources would show considerable timber remaining if it could be made accessible.

El Salvador is the only source of Peruvian balsam, a medicinal product of "*myroxylon pereirae*." This is used in surgical dressing and for skin diseases. From it cinnamic acid is derived. As the balsam went to Europe in colonial times by way of the Isthmus of Panama, where it became mixed with goods from Peru, it was credited to that country and thence derived its name. It is almost wholly a sylvan product. The tree requires 25 years to mature for tapping. Between 40 and 50 tons are exported annually, the value fluctuating from \$2,700 to \$4,000 a ton. The United States takes 66, and Germany 22, percent.

Rubber, which was exported to some extent as recently as 1926, is of no appreciable consequence at present.

Livestock raising.—Livestock is raised in all of the Provinces of El Salvador, and the Statistical Annual for 1930 shows a total of 756,000 head of stock. According to that publication there were 355,000 swine, 328,000 cattle, 7,000 goats, and 66,000 horses, mules, and asses. Domestic fowls are common and well distributed.

MANUFACTURING

Manufacturing in El Salvador is almost entirely on a handicraft basis and is limited practically to domestic consumption. There are a few small textile mills producing colored drills and cheap cotton cloths and a

cheap grade of cotton stockings. Their production has entirely shut out certain classes of cotton goods, and resident Chinese are producing pongees and other silk fabrics at prices with which importers cannot compete. Two or three straw-hat factories exist. Breweries, bottling works, soap factories making the cheaper grades, and cigarette and cigar factories are to be found. A number of tile factories turn out some artistic lines of Spanish tiles. There are a few tanneries. Most of the men's and women's shoes are produced domestically, the better qualities being made from imported soles, uppers, and findings. Ninety-five percent of men's and women's wear is made up domestically from imported fabrics. Practically all the bacon and much of the ham consumed is produced in the country and most of the furniture used is made from local woods, with some wickerwork.

The lack of developed basic material sources, such as coal, iron, and other metals, and industrial chemicals, hampers the industrial growth of El Salvador. Nevertheless, the Government is desirous of developing industries and every facility is offered in the way of tariff protection and free raw materials to those contemplating the establishment of industries in the country.

MINING

There are deposits of gold, silver, copper, lead, iron, mercury, and coal in El Salvador, but so far as is known none of them is being exploited at present with the exception of some small-scale workings of gold deposits in the Department of La Libertad.

A group of gold mines near Santa Rosa, La Libertad, was operated successfully by a Canadian company during 1920 and 1921. They were then believed to be worked out, but there are some workings on a small scale there now. Work on another group located near the town of Comacaran, San Miguel, was suspended in 1919 due to a shortage of firewood. A third group of gold mines, known as Monte Cristo which has been under development for some time, is said now to be awaiting the report of an engineer who examined it recently.

There was formerly a large silver-producing mine near the village of Divisadero, but it has been idle for a number of years. The Monte Mayor mines near Gigante, Morazan, have a fully equipped reduction plant for silver and there are some low-grade silver veins about 10 miles (16 kilometers) west of Divisadero, between the towns of Chapeltique and Sessori. These latter have been explored recently, but due to depressed conditions no work has been done.

Deposits of coal are found in the Rio Lempa Valley and also in the Sensenti Valley, to the north of the Lempa Valley. An analysis of the Lempa Valley coal made by Edward W. Best in 1850 showed it to contain 5.5 percent volatile material, 85.5 percent carbon, and

9 percent ash. None of these deposits have been worked.

WATER POWER

The statistical bureau of El Salvador estimates available water power to be around 300,000 horsepower and states that there are 10 or 12 points on the Rio Lempa where from 5,000 to 8,000 horsepower could be developed. Many streams flow down the steep southern mountain slopes into the Pacific Ocean and, although the volume of water fluctuates greatly between the rainy and dry seasons, there is sufficient water and fall to develop considerable power. There are 23 electric light and power plants in El Salvador, with a total generating capacity of nearly 5,000 kilowatts.

TRANSPORTATION AND COMMUNICATION

Ocean transport.—Ocean rates from New Orleans have been established on a basis of equalization with those from Atlantic and Pacific ports of the United States, giving New Orleans something of an advantage in the way of time saving. Although the new railway line (International Railways of Central America) has not materially affected Pacific coast ports as yet, it seems probable that equalized rates and faster deliveries will eventually cause freight competition. Puerto Barrios is said to offer better handling facilities than are to be obtained at either La Libertad or Acajutla, both of which are open roadsteads, and service through Puerto Barrios is faster, especially for the western section of El Salvador which is served by Santa Ana. An increasing percentage of the coffee exported from El Salvador is moving to the United States through Puerto Barrios and there may be opportunities for establishing bonded warehouses at that port. The new Guatemalan customs code authorizes such a warehouse and it is possible that one will be established either by the railroad or an American fruit company. The construction of a bonded warehouse at Puerto Barrios would permit distribution from that port to the greater part of the Republics of El Salvador and Guatemala and also to the north coast of Honduras. A total of 723 ocean vessels, with an aggregate tonnage of 1,697,585, called at Salvadorean ports in 1930. Of these ships, 303, with a tonnage of 721,495, were of American registry and 180, of 168,340 registered tons, were British.

Highways.—The Salvadorean road building and maintenance administration, which for a time had to suspend the greater part of its highway-building program due to lack of funds, has recently resumed operations on a relatively ambitious scale. Its equipment, only about one-tenth of which is in use at present, consists of tractors, graders, surfacers, pulverizers, trucks, and other machines, to a total value of perhaps \$125,000.

The Republic's highway system comprises about 30 miles (48 kilometers) of asphalt-paved road; 900 miles (1,448 kilometers) of dirt roads, rated as negotiable for motor transport throughout the year, but which really are very rough during the rainy season; and 2,200 miles (3,573 kilometers) of unimproved dirt roads, practically suitable only for ox carts.

Highway construction and maintenance are under the jurisdiction of the National Department of Public Works, while the Provinces maintain departmental road commissions.

Railways.—There are 375 miles (603 kilometers) of railways in El Salvador. The country is served by two lines: The Salvador Railway (British) which connects the country's most important port, Acajutla, with San Salvador, 65 miles (105 kilometers) distant; and the International Railways of Central America.

It is believed that the recently completed Zacapa-San Salvador extension of the International Railways of Central America from Guatemala to El Salvador will furnish more rapid service from the main export centers of the United States. Heretofore, El Salvador has had no outlet to the Caribbean Sea and the longer period required in order to obtain shipments has forced merchants to carry relatively larger stocks than business firms in Guatemala. With a widely defined depression in business conditions in El Salvador smaller stocks and quicker turn-over are finding favor.

Inland waterways.—There are numerous rivers and lakes in El Salvador, but other than the Rio Lempa none is navigable except for very small craft.

Airways.—There is only one first-class airport in El Salvador. This is a joint military and commercial airport located at Ilopango, approximately 8 miles (13 kilometers) from San Salvador. There are in addition four other landing fields.

No local commercial air transportation company operates in the country. Pan American Airways holds a contract with the Government for the carriage of mails by air to foreign countries; a Honduran company operates between that country and San Salvador. Overnight stops are made by the planes of Pan American Airways at San Salvador on its service through the country.

Automotive statistics.—The registration of automotive vehicles in El Salvador January 1, 1933, was 2,200, divided by types as follows: Passenger cars, 1,860; busses, 80; trucks, 260.

A majority of these is owned and driven in the capital and vicinity where most of the improved roads are found.

The figures shown in table 6 were realized by the customs department of El Salvador from duties on the commodities indicated for 1930.

TABLE 6.—Customs receipts for commodities indicated for 1930

Article	Weight	Value
	<i>Kilos</i>	<i>Colones</i>
Automobiles.....	298, 440	361, 552
Trucks.....	91, 249	104, 456
Bicycles.....	2, 682	9, 644
Gasoline.....	6, 552, 476	860, 256
Crude oil.....	18, 869, 877	219, 722
Kerosene.....	2, 249, 450	148, 602
Total.....		1 1, 704, 232

¹ \$852,116 in United States currency.

HIGHWAY ECONOMICS

Existing bus routes.—The American Vice Consul at San Salvador reports that there are 535 cars for hire—busses and taxicabs—on established intercity routes. The total number of busses in operation is estimated at 300.

The largest bus line is Salvador Bus, operating 40 single-deckers, capacity 15 to 25 passengers. They operate in and around the city; to the adjoining towns of San Jacinto, Mejicanos, and Aculhuaca; and from the railroad stations at San Salvador to the Rosales Hospital. The next largest line is Ansart, with 10 busses of 15- to 20-passenger capacity, running from the railroad stations to about a mile (1.6 kilometers) beyond Rosales Hospital. Other companies are small, some operating only one bus, and working the same routes.

Passenger-car busses work out of San Salvador to (1) the central zone of the Republic, including Chalanango, Suchitoto, Cojutepeque, and interlying towns; (2) the western section as far as Santa Ana; and (3) the port of La Libertad. There are also shorter runs to San Marcos and Santo Tomas, Soyapango, and Santa Tecla. From Santa Ana, Sonsonate, Usulután, and San Miguel other lines cover the nearby towns. It is estimated that 1,500,000 passengers are carried annually by busses.

Potential bus routes.—The following connections with the proposed route of the inter-American highway suggest potential bus routes:

1. San Salvador, west to Santa Tecla and Sonsonate, thence south to Acajutla. Rental cars travel this route in the dry season.
2. San Salvador in a southeasterly direction to Zacatecoluca.
3. San Salvador, north to Ocotepeque.
4. Cojutepeque, north to Llobasco.
5. San Miguel, north to San Francisco.
6. Santa Ana to Ahuachapan, and from Ahuachapan to Sonsonate.

By decree effective January 1, 1934, the capital tax law has been so amended that revenues derived from vehicle licenses, estimated at \$200,000 annually, shall be allocated for road construction and maintenance. Taxes on passenger cars will range from 46 to 81 colones; solid-tire trucks, 106 to 656; pneumatic tires, 66 to 406 colones. There is also a special "welfare levy" of 6 colones on trucks and cars.

Tourist traffic.—No statistics are available as to the number of tourists visiting El Salvador annually. In general it may be said that the traffic is from boat to capital (San Salvador) to boat. A few tourists go in at San Jose, Guatemala, spend a day at Guatemala City and then proceed by rail to San Salvador. Some, traveling on small boats that touch at Acajutla, enter that port, go to the capital, and join the boat at La Libertad. The great majority enter at La Libertad where vessels are scheduled to arrive in the morning, and proceed to the capital by automobile, returning to the vessel in the evening. With the completion of the inter-American highway it is predicted that a great many tourists will proceed by rail to Guatemala City, from San Jose on the Pacific Ocean and Puerto Barrios on the Atlantic Ocean, and then go to San Salvador by bus or automobile.

PUBLIC LANDS

El Salvador is unique among the Central American republics in that no public lands remain available for entry. Most of the country has been divided into medium- and small-sized parcels of land which are controlled entirely by private enterprise. As heretofore stated, fertile lands are available and cheap in the Departments of La Union and Morazan.

FOREIGN TRADE

Table 7 shows the foreign trade of El Salvador for the years 1928–32, inclusive.

For the decade 1923–32 the favorable trade balance was \$34,333,000, or an annual average of \$3,433,300. Per capita imports averaged \$9.32 compared with per capita exports of \$11.68. The United States ordinarily takes from 15 to 18 percent of El Salvador's exports and supplies 50 to 52 percent of its purchases. (See appendix C.)

In 1930 El Salvador's imports of foodstuffs and beverages totaled \$1,567,000, or about \$1.07 per capita. This was a poor year. The previous year was more nearly a normal one when the imports under this classification totaled \$2,709,000, or \$1.86 per capita. The nature of the imports, the high duties placed thereon, and the low per capita purchasing power of the inhabitants all point to the conclusion that imported foodstuffs and beverages are almost wholly consumed by the well-to-do class.

Merchandise distribution.—By place or manner of entry El Salvador's commerce for 1929, 1930, 1931, and 1932 is shown in table 8.

TABLE 7.—Foreign trade, 1928–32

Year	Total imports	Total exports
1928.....	\$19, 200, 000	\$24, 450, 000
1929.....	17, 350, 000	18, 400, 000
1930.....	11, 950, 000	13, 650, 000
1931.....	7, 300, 000	11, 350, 000
1932.....	5, 009, 000	5, 531, 000

TABLE 8.—Imports and exports, in tons, by place or manner of entry

Place or manner of entry	1929		1930		1931		1932	
	Im-ports	Ex-ports	Im-ports	Ex-ports	Im-ports	Ex-ports	Im-ports	Ex-ports
Port of Acajutla.....	37,032	23,249	13,072	25,389	9,874	22,224	5,864	16,531
Port of La Libertad....	15,835	7,594	11,680	10,170	12,394	8,505	11,082	7,705
Port of La Union.....	82,231	24,097	54,113	28,013	27,786	25,414	18,696	15,566
Puerto Barrios, Guatemala.....	10		2,978		4,710	4,497	3,442	2,902
Contiguous countries.....			1,160	2,956	(1)	(1)	(1)	(1)
Parcel post.....	166		138		(1)	(1)	(1)	(1)
Air.....			1		(1)	(1)	(1)	(1)
Total.....	135,274	54,940	83,142	66,528	54,764	60,640	39,084	42,704

¹ Further details not available.

From this it appears that about 55 percent of the foreign trade passes through La Union (Cutuco), the only protected port in the Republic; 26 to 31 percent through Acajutla; and 12 to 15 percent through La Libertad.

It has been estimated that about 65 percent of the goods imported into El Salvador is used or consumed in San Salvador, the capital, or nearby territory. The Santa Ana and Santa Lucia districts take about 15 percent. This territory is served by the International Railways of Central America and the Salvador Railway (British) from the port of Acajutla. Those districts between San Salvador and the ports of Acajutla, La Libertad, and La Union take about 10 percent of all imports. The other 10 percent generally is distributed throughout the country.

These figures unquestionably indicate a very restricted distribution of commodities in a country with a relatively advanced development as compared with other states of Central America. The opening of other and more flexible lines of transport should encourage a wider distribution and a correspondingly better scale of living.

The important business of El Salvador is done by German, French, Italian, Spanish (Catalonian), and Chinese houses. English and American representation is small but the opportunity for American trade must be relatively large because of the heavy preponderance of American imports and the tariff convenience. The United States enjoys a preferential tariff with El Salvador known as "Table B", which also applies to goods from France, Germany, Italy, Switzerland, and Spain. This table includes such items as sardines, certain condiments, vegetables, meats, fish in glass or tins, dried and preserved fruits, cheese, candy, perfumery, fancy biscuits, sugar, paint brushes and other brushes, rubber articles (except tires and tubes), jewelry, buttons, and surgical instruments.

Taking 1929 as a fairly normal year, table 9 shows principal countries of origin and principal items of imports;

TABLE 9.—Principal countries of origin, principal imports, and percentage of total imports

Country	Item	Percentage
United States..	Textiles, automobiles, pharmaceuticals, iron, steel, flour, oil, electric goods.	52.20
Great Britain..	Cotton goods, bags, paper, coffee, machinery, paints.	14.74
France.....	Chemicals, perfumes, iron, steel, wines, cosmetics.	5.83
Germany.....	Fertilizers, chemicals, glassware, iron, steel, electrical goods, papers, soap, paints.	1.15
Belgium.....	Glassware, iron, steel, fertilizers.	1.52
Peru.....	Kerosene, gasoline.	2.02
Italy.....	Hats, chemicals.	2.56
Japan.....	Silk goods, porcelain.	3.52
Nicaragua.....	Cheese.	1.12
Norway.....	Cement.	.61
Sweden.....	Matches, cement.	1.55
Spain.....	Cigarette paper.	1.66

FINANCE

National revenues.—About 60 percent of the Government's revenues has been derived from customs duties, import and export, the former accounting for more than 50 percent of the total ordinary revenues. For example, of the \$13,500,000 total of revenues for 1928-29, nearly \$8,500,000 came from both import and export duties, and \$6,850,000 from import duties alone. Liquor taxes are second in importance, ordinarily yielding over \$2,000,000 annually. Stamp tax proceeds have been steadily increasing until they now yield about \$450,000. The income from national properties fluctuates and is negligible. Public services yield about \$500,000; direct taxes, which yielded \$424,000 in 1923, dropped to \$325,000 in 1926, and rose to \$718,000 in 1929. There is no land tax.

Receipts and expenditures.—The fiscal year ends June 30. Closed accounts, however, are for calendar years. Only ordinary receipts and expenditures are available for the periods covered in detail in tables 10 and 11.

Tables 10 and 11 give revenues and expenditures for El Salvador for the fiscal year 1932-33, as furnished by the American vice consul at San Salvador.

TABLE 10.—Source of Government revenues for the fiscal year 1932-33

	Colones ¹
Customs.....	10,944,133
Consular fees.....	693,518
Liquor taxes.....	1,804,870
Communications.....	863,089
Miscellaneous, including coffee surcharges.....	4,086,662
Total.....	² 18,392,272

TABLE 11.—Purpose of Government expenditures for the fiscal year 1932-33

	Colones
Legislative.....	155,996
Executive.....	136,142
Interior.....	2,599,818
Labor.....	8,904
Public works.....	849,925

¹ Par colon equals 50 cents, United States currency.

² This total exceeded that for 1931 by nearly 800,000 colones, was 3,300,000 below the total for 1930, and nearly 8,000,000 below the total for 1929.

TABLE 11.—*Purpose of Government expenditures for the fiscal year 1932-33—Continued.*

	Colones
Agriculture.....	54, 252
Public health.....	250, 736
Foreign affairs.....	417, 725
Justice.....	416, 312
Education.....	1, 492, 766
Welfare.....	595, 292
Finance.....	1, 137, 528
Industry and commerce.....	5, 820
War, navy, and aviation.....	3, 169, 168
Judicial.....	554, 544
Pensions.....	439, 729
Specific fund.....	1, 420, 371
Pending.....	432, 202
Public credit.....	3, 794, 562
Total.....	¹ 17, 931, 792

Public debt.—Figures supplied by the American vice consul at San Salvador show the following to comprise the public debt of El Salvador as of July 31, 1933, expressed in colones:

TABLE 12.—*Public debt as of July 31, 1933*

Item	Principal	Interest due	Total
	Colones	Colones	Colones
Dollar bonds, series A, 8 percent.....	7, 304, 000	478, 133	7, 782, 133
Sterling bonds, series B, 6 percent.....	8, 938, 300	826, 467	9, 764, 767
Dollar bonds, series C, 8 percent.....	18, 020, 600	1, 997, 283	20, 017, 883
Subtotal.....	34, 262, 900	3, 301, 883	37, 564, 783
Internal obligations.....	9, 079, 960	72, 253	9, 152, 213
Total.....	43, 342, 860	3, 374, 136	46, 716, 996
Cash on hand.....			1, 302, 156

American investments in El Salvador.—According to Trade Information Bulletin No. 767 of the United States Department of Commerce, American investments in El Salvador at the end of 1930 totaled \$34,732,000, of which \$29,466,000 was in the form of direct investments and \$5,266,000 were invested in national Government securities.

Coffee and sugar properties, railways, light, power and ice manufacturing plants, mining, banking and industrial enterprises, form the bulk of the direct investments mentioned above.

Some of the American firms and individuals having important investments in El Salvador are:

The International Railways of Central America: Owns nearly 300 miles (483 km) of railway.

R. W. Hebard & Co.: Has constructed highways and sanitary works.

Banco Occidental, San Salvador: Capitalized at \$5,000,000: Is controlled by American interests in San Francisco.

Moisant Sugar Estate: Owns a sugar factory and other lands and buildings, valued at approximately \$600,000.

Central American Mines, Inc.: Operates gold and silver mines through its subsidiary, the Butters-Divisadero Co.

The International Power Co., Ltd., Montreal: A Canadian company in which American capital is interested. Owns and operates light and power plants in a number of municipalities.

¹ This total slightly exceeded that for 1931, was 5,000,000 colones less than the total for 1930, and 9,000,000 colones less than the total for 1929.

Other American investments in Salvador are those of the All American Cables, Inc., Richard Kriets, Marc Bunnell, and Pan American Airways.

British investments in El Salvador at the end of 1928 included \$4,000,000 in the Salvador Railway, and \$4,800,000 in Government bonds. Dr. Max Winkler reports a total of \$9,746,000 for all British investments in 1929. Other foreign nationals had invested about \$2,000,000 in El Salvador at the end of 1928.

TECHNICAL SECTION

The proposed route.—Although no survey was made through El Salvador, and consequently no photographic mosaics are included in this report, the general line of existing roads and of projected surveys is shown on a series of line and profile sheets as in the other republics. Data for these sheets were obtained through the courtesy of the officials in El Salvador in charge of highway development, and description of the line was supplied through a member of the Inter-American Highway Commission for El Salvador.

The principal termini of the route of the inter-American highway in El Salvador are the crossing of the Rio Goascoran at the Santa Clara Bridge site, on the boundary between Honduras and El Salvador, and a small stream defining the boundary between El Salvador and Guatemala, near the village of San Cristobal.

Connections are made with the national system of railways at San Miguel, San Vicente, Cojutepeque, San Salvador, Santa Tecla, and Santa Ana. The railroad system connects with the important ports of Acajutla and La Union and one branch extends into Guatemala.

At San Salvador connection is made with the Pan American Airways system.

Junction is made at San Miguel with earth roads leading to the surrounding country, of which the principal ones are to La Union on the Gulf of Fonseca and to the Department of Usulután; at San Vicente with earth roads extending north toward Honduras and south toward Zacatecoluca; at Cojutepeque with north and south earth roads and trails; at San Salvador with radiating earth roads, the more important of which are one to Ocotepeque, Honduras, to the north, and another to Zacatecoluca to the south and east; at Santa Tecla with an improved road to the important port of La Libertad; and at Santa Ana with important earth roads, the chief of which is to Ahuachapan. Just west of Santa Tecla there is a junction with an earth road that goes to the important town of Sonsonate and thence to the port of Acajutla.

Control points.—The following control points have been selected for the purpose of adequately defining the chosen route:

1. Santa Clara crossing of the Rio Goascoran at the Honduras border.

2. San Miguel, one of the important cities of the Republic.
3. The crossing of the Rio Lempa.
4. San Vicente, an important center of population and trade.
5. Cojutepeque, an important town.
6. San Martin, a village.
7. Ilopango, a village.
8. Soyapango, a village.
9. San Salvador, the capital of the Republic.
10. Santa Ana, the second largest city of the Republic.

11. A small stream, 5.5 miles (9 kilometers) northwest of Candelaria, El Salvador, and near San Cristobal. This is the Guatemalan boundary.

Running description.—The route from the Santa Clara crossing of the Rio Goascoran to San Miguel is through a broken and rolling country, the general elevation of which is moderately low. It passes through Santa Rosa de Lima, Jocoro, and near the Divisadero mines, all of which lie within an old mining section.

The first 9 miles (15 kilometers) from the Santa Clara crossing are passable with motor cars, but not without difficulty. From this point to San Miguel the road has been partly graded and surfaced, and is traversable with moderate comfort in automobiles.

Continuing from San Miguel through Moncagua, Chinameca, Jucuapa, Umana, and Mercedes to the crossing of the Rio Lempa, the route lies in a somewhat more elevated terrain. The present road is easily negotiated by automobile as far as Jucuapa, a town in a splendid coffee district and at an elevation of approximately 2,300 feet (700 meters). From this point to the Rio Lempa crossing no work has been done on the present road which is passable to motor vehicles only with considerable difficulty.

The roughest and most expensive section of the route in El Salvador is that between the Rio Lempa and San Vicente. This part is at present almost impassable for automobiles.

A location which has been made through here by the national authorities develops the need of several expensive structures, including an important bridge over the Rio Acahuapa and another of 1,000 feet (305 meters) in length over the Rio Lempa. At the point of the Rio Lempa crossing, the elevation is approximately 100 feet (30 meters) above sea level.

There is a slight rise from San Vicente to Cojutepeque via San Rafael Cedros. The present road is of earth and is in fair condition the entire year. It passes over very broken terrain and through a section of much natural beauty.

The present road along the next section from Cojutepeque to Soyapango passes through broken terrain, but is passable to automobiles with reasonable comfort the year round. From Soyapango to San

Salvador there is a road surfaced with oil-treated waterbound macadam.

Leaving San Salvador the present road is paved with bituminous concrete to Santa Tecla. From this point to Santa Ana via Colon, El Chilamatal, and Coatepeque, the present road is graded and in good condition the year round, with the exception of about 11 miles (18 kilometers) near Coatepeque which has not been graded, but is in good natural condition.

From Santa Tecla to Colon the route passes through a narrow canyon formed by the volcano San Salvador and the hills of La Cumbre, then through a fertile valley in which are located the villages of San Andres and El Sitio del Nino, and thence through broken terrain to Santa Ana.

From Santa Ana to the Guatemalan frontier, via Candelaria and Paraje Galan, the road passes through rather level country and is surfaced for 3 miles (5 kilometers) with penetration macadam, for 5.5 miles (9 kilometers) with waterbound macadam, and with gravel and talpetate for the remainder of the distance, with the exception of the last 1.25 miles (2 kilometers) which are only graded.

Alinement.—The alinement of the improved sections of road in El Salvador is satisfactory. It is understood that a limiting minimum radius of curvature of 190 feet (58 meters) has been used. There are parts of the route where it will be somewhat expensive to maintain this minimum, but it will be justified by the results.

Gradients.—Entering El Salvador from Honduras at an elevation approximating 145 feet (44 meters) there is a gradual rise over undulating ground to Jocoro at 750 feet (229 meters) elevation, and from there a fall of 350 feet (107 meters) over broken terrain to Managua at 400 feet (122 meters) elevation. From this point there is a rise of 2,020 feet (616 meters) in 8 miles (13 kilometers) before reaching a summit near Jucuapa. The drop from this summit to the crossing of the Rio Lempa is 2,320 feet (708 meters) in a distance of 18.5 miles (30 kilometers). The next 35 miles (56 kilometers) have a rise of 2,680 feet (817 meters) where Cojutepeque is reached. From this point there is a fall of 710 feet (217 meters) to Ilopango, thence a rise of 1,000 feet (305 meters) to Santa Tecla, followed by a fall of 1,650 feet (503 meters) to Rio Sucio, a rise of 1,350 feet (412 meters) to the summit, another fall of 770 feet (235 meters), followed by a rise of 920 feet (281 meters), and finally a fall of 770 feet (235 meters) which brings one to the El Salvador-Guatemala border at an elevation of 2,150 feet (656 meters).

It will be noted that the point of entering El Salvador is 2,005 feet (612 meters) lower than the point of leaving. Between these termini there are six well-defined ascents, one of which rises to an elevation of 3,070 feet (936 meters) and of the corresponding

descents, one reaches a minimum elevation of 100 feet (30 meters).

From the foregoing it seems highly probable that there will be many places where it will be economical to utilize the maximum allowable gradient.

Mountains and valleys.—From the Santa Clara crossing of the Rio Goascoran to San Miguel the route follows the Rio Santa Rosa, a tributary of the Rio Goascoran, to near Jocoro in the drainage basin of the Rio Miguel. It crosses several tributaries of the latter river, the principal one of which is the Rio de Santa Rosa. Leaving San Miguel it goes a short distance up the valley of the Rio Moncagua, then turns west and crosses the Rio Lempa, reaching San Vicente via the valley of the Rio Acahuapa, another tributary of the Rio Lempa.

From San Vicente to Santa Ana the general location is along the elevated ground that lies between the tributary waters of the Rio Lempa and the Pacific Ocean. The Rio Lempa practically parallels the route between these points.

From Santa Ana to the Guatemala border the line is on terrain that lies between the waters tributary to the Rio Lempa and the Rio La Paz.

Principal drainage.—The Rio Lempa enters El Salvador near its northwest corner, flows south about one-half the distance across the country, then turns east and flows in this direction until it passes the meridian of San Vicente, thence turns abruptly south and empties into the Pacific Ocean. This stream drains the greater part of the Republic. Other important drainage areas are those of the smaller streams flowing to the Pacific Ocean and those of the Rios Goascoran, Sucio, and La Paz.

Soil conditions.—From the meager data obtainable about El Salvador it seems reasonable to suppose that there is an abundance of road material available and that the soil throughout the Republic is well adapted to road building.

In the southeast and northwest, the two sections entered by the engineers of the survey, conditions were found to justify the assumption that the country throughout offers no particular building problems as related to materials or soil conditions.

Existing roads used.—Practically the whole route through El Salvador has been reconnoitered and a great deal of it located by the national highway authorities. Use is made of the existing location from the Rio Goascoran to San Miguel and from the Rio Lempa to San Vicente. The constructed road from a point 4 miles (6 kilometers) east of San Salvador to Santa Tecla, the graded road from Santa Tecla to Santa Ana, and the constructed road from Santa Ana to the El Salvador-Guatemala border are included in the route of the inter-American highway. In addition it is

expected that the line, when located, will approximate the old road now existing between the points where no work has heretofore been done.

Estimates of cost.—Tables 13, 14, and 15 itemize the estimated costs on the principal phases of the operations in El Salvador.

The total length of the proposed inter-American highway in El Salvador is 183 miles (295 kilometers).

Estimates for type 1, table 13, contemplate the construction of 89 miles (143 kilometers) of all-weather road with a 28-foot (9-meter) graded section and a surface of local material 18 feet (5.5 meters) wide and 6 inches (15 centimeters) compacted depth.

Estimates for type 2, table 14, contemplate all included under type 1 and the widening of 95 miles (153 kilometers) of road already constructed, in addition to oiling 125 miles (201 kilometers), 89 miles (143 kilometers) of which are included in type 1.

Estimates for type 3, table 15, contemplate the construction of 183 miles (294 kilometers) of road with a 32-foot (10-meter) graded section and a surface of concrete 20 feet (6 meters) wide and 8 inches (20 centimeters) thick.

All existing bridges are to be widened to a 20-foot (6-meter) roadway. All new bridges are to have a 20-foot (6-meter) roadway.

One-half the cost of the bridge over the Rio Goascoran between El Salvador and Honduras is included in all estimates.

The principal stream crossings in El Salvador are shown in table 16 and the length of span is indicated for bridges not yet constructed.

TABLE 13.—*Estimates for type 1*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	40	Miles.....	\$250. 00	\$10, 000. 00
Unclassified excavation.....	708, 800	Cubic yards.....	1. 00	708, 800. 00
Small drains.....	60, 000	Linear feet.....	7. 00	420, 000. 00
Bridges.....	2, 125	do.....	200. 00	425, 000. 00
Surfacing.....	207, 944	Cubic yards.....	2. 50	519, 860. 00
Total.....				2, 083, 660. 00
Add 12½ percent for engineering and contingency.....				260, 457. 50
Total estimate.....				2, 344, 117. 50

TABLE 14.—*Estimates for type 2*

Item	Quantity	Unit	Unit cost	Amount
Unclassified excavation.....	200, 000	Cubic yards.....	\$2. 50	\$500, 000. 00
Small drains and bridges.....				50, 000. 00
Oil.....	660, 000	Gallons.....	. 20	132, 000. 00
Total.....				682, 000. 00
Type 1, all items.....				2, 083, 660. 00
Total.....				2, 765, 660. 00
Add 12½ percent for engineering and contingency.....				345, 707. 50
Total estimate.....				3, 111, 367. 50

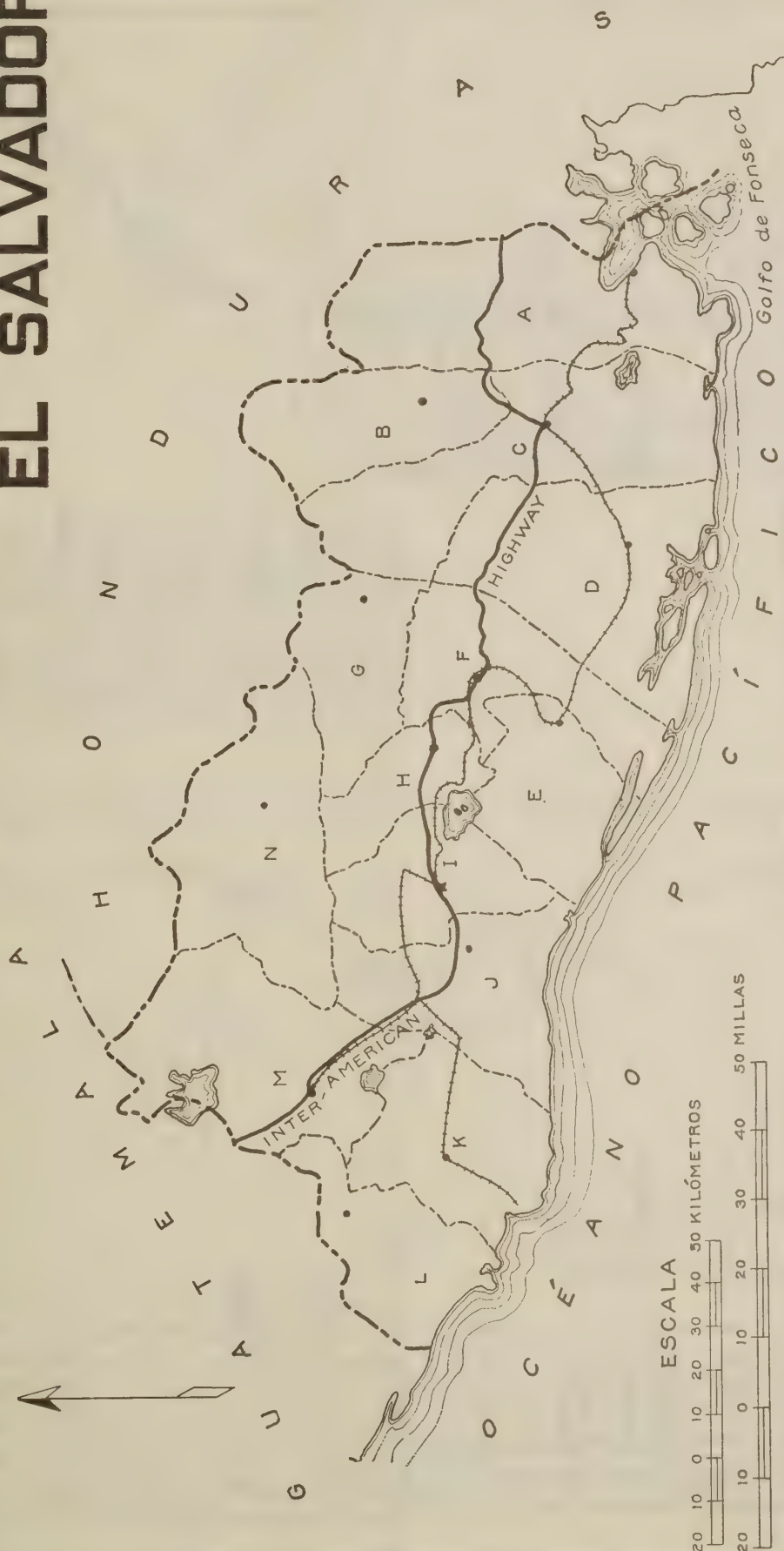
TABLE 15.—*Estimates for type 3*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	40	Miles.....	\$250	\$10,000
Unclassified excavation.....	958,000	Cubic yards...	1	958,000
Small drains.....	75,000	Linear feet....	7	525,000
Bridges.....	2,125	do.....	200	425,000
Surfacing.....	477,600	Cubic yards....	15	7,164,000
Total.....				9,082,000
Add 10 percent for engineering and contingency.				908,200
Total estimate.....				9,990,200

TABLE 16.—*Principal stream crossings*

Name of stream	Length of bridge span	
	Feet	Meters
Rio Goascoran.....	650	200
Quebrada Divisadero.....	30	9
Rio Santa Ana.....	60	18
Rio San Miguel.....	120	36
Rio Lempa.....	1,000	305
Rio Acahuapa.....	150	46
Do.....	60	18
Rio Michapa.....	30	9
Rio Sucio.....	150	46
Rio Sarca.....	60	18
Rio Sota.....	50	15
Rio Molino.....	30	9
Quebrada El Sauce.....	30	9
Quebrada.....	30	9
Total.....	2,450	747
Less one-half the length of the bridge over the Rio Goascoran.....	325	99
Total estimate.....	2,125	648

EL SALVADOR



DEPARTAMENTO	CAPITAL	DEPARTAMENTO	CAPITAL
A LA UNION	LA UNION	H CUSCATLÁN	COJUTEPEQUE
B MORAZÁN	GOTERA	I SAN SALVADOR	SAN SALVADOR
C SAN MIGUEL	SAN MIGUEL	J LA LIBERTAD	SANTA TECLA
D USULUTÁN	USULUTÁN	K SONSONATE	SONSONATE
E LA PAZ	ZACATECOLUCA	L AHUACHAPAN	AHUACHAPAN
F SAN VICENTE	SAN VICENTE	M SANTA ANA	SANTA ANA
G CABANAS	SENSUNTEPEQUE	N CHALATENANGO	CHALATENANGO

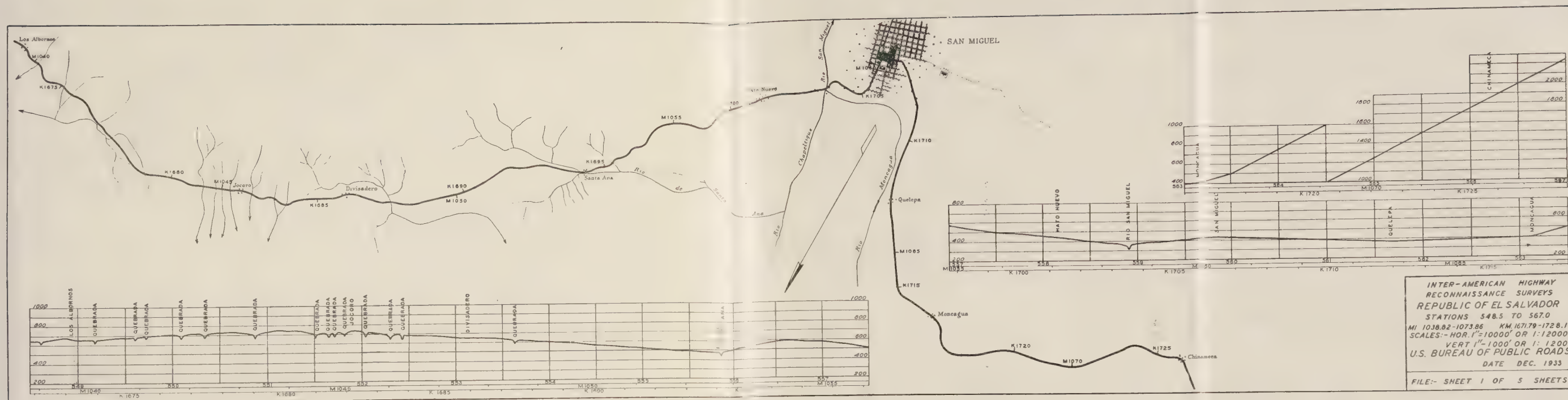


PLATE 40.



PLATE 41.

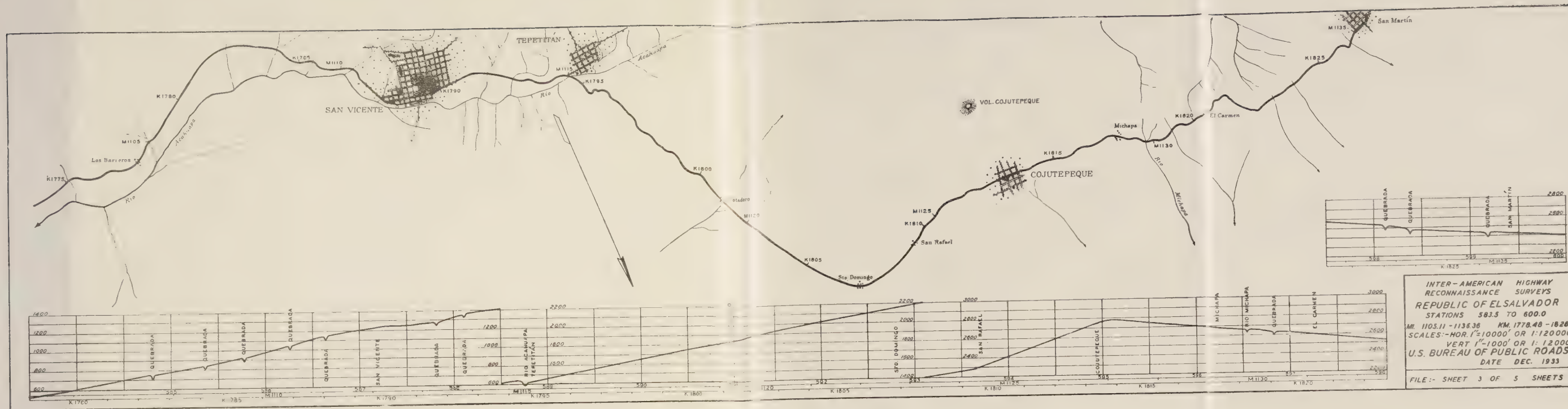


PLATE 42.

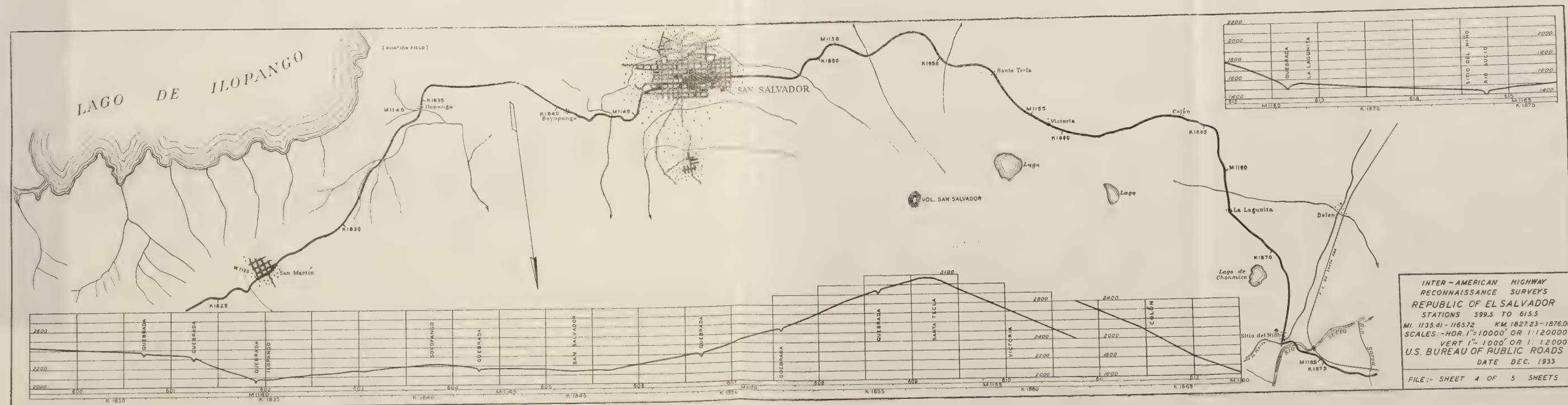
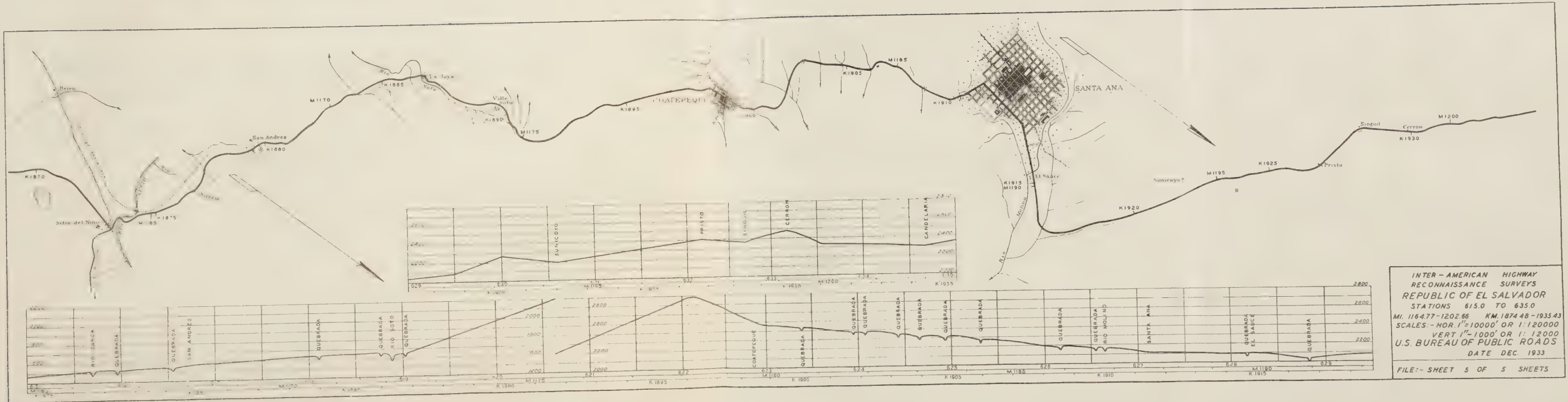


PLATE 43.



PROPOSED INTER-AMERICAN HIGHWAY

REPORT OF A RECONNAISSANCE SURVEY FOR THE
PROPOSED INTER-AMERICAN HIGHWAY

PART VII.—REPUBLIC OF GUATEMALA—REPUBLIC OF MEXICO

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

BUREAU OF PUBLIC ROADS
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C.

GUATEMALA

GENERAL SECTION

HISTORY

Guatemala was invaded by the Spanish under Pedro de Alvarado in 1522. He was sent to that region by Hernando Cortes, the conqueror of Mexico. By 1524 Alvarado had reduced the aborigines to terms and founded the first capital, Santiago de Guatemala, at the present site of Tecpam. In 1527 Alvarado's brother removed the capital to the site now known as Ciudad Vieja. Pedro, who had been named governor of the territory, was killed in 1541 while leading troops in Mexico. The horse he was riding plunged from a cliff. On being informed of his death the Spanish colony in Guatemala named Pedro's wife Beatriz de la Cueva to succeed him. Beatriz was the first woman executive of the New World, but her term was short. Very soon afterward the crater of Volcano Agua blew out and a torrent of mud and water destroyed the capital. Beatriz and her ladies-in-waiting were among the many killed. The ruins of the chapel in which they perished are still standing. The capital was removed to the present Antigua, which in 1773 was destroyed by an earthquake. It was then removed to the present site. Under a Captaincy-General, Guatemala comprised up to 1822 all that territory now known as Central America, together with Chiapas and Soconusco. In that year Emperor Agustin (de Iturbide) was proclaimed by the government of the Mexican Empire ruler of all the lands extending from the forty-second parallel of north latitude to the Isthmus of Panama.

Emperor Agustin was deposed in March 1823. In July of that year a National Constituent Assembly, gathered at Guatemala City, announced that the provinces of the former Captaincy-General of Guatemala were free and independent states confederated into a nation—the United Provinces of Central America. Chiapas remained incorporated with Mexico. A constitution was promulgated November 22, 1824, by which the Provinces of Costa Rica, Guatemala, Honduras, Nicaragua, and El Salvador associated themselves in a federation. This federation was dissolved in 1839.

Guatemala declined to join the confederation attempted at Chinandega, Nicaragua, in 1842, temporarily resuscitated in Leon in 1849, and abandoned during the conflict between Guatemala and El Salvador in 1863. The present title, "Republic of Guate-

mala", was adopted in 1847. In February 1885 President Justo R. Barrios attempted by proclamation to reestablish a Central American Union, but Barrios was killed in a battle with Salvadoreans the following April. When in 1898 Honduras, Nicaragua, and El Salvador signed at Managua a constitution for the United States of Central America, growing out of the Amapala Conference of 1895, provision was made for the admission of Guatemala, but this federative movement collapsed in 1899. Guatemala was a signatory to the Treaty of Union of the Federation of Central America, adopted at San Jose, Costa Rica, in 1921, and its congress ratified that treaty, but the coup d'état which deposed President Herrera of Guatemala in December of that year also insured the failure of the federation.

As the home of the Mayans, possibly antedating their habitation in Yucatan, Guatemala offers a host of archaeological subjects appertaining to that ancient race. The historian will find a wealth of primary source material in the national and various municipal archives. The antiquarian can revel in sixteenth century objects of art. It is a country where one may step from modernity to antiquity—from A. D. to B. C.—as easily as to and from the treads of an escalator.

GEOGRAPHY, TOPOGRAPHY, AND AREA

Guatemala is the northernmost republic of the Central Americas, and is bounded on the north by the Republic of Mexico (Yucatan); and on the east by British Honduras, the Gulf of Honduras, the Republic of Honduras, and the Republic of El Salvador; on the south by the Pacific Ocean; and on the west by the Republic of Mexico. It has an estimated land area of 42,364 square miles (109,720 square kilometers), and is the third in size of the Central American republics.

A plateau varying in elevation from 4,000 to 11,500 feet forms the interior section of Guatemala. It is bordered on the Pacific side by a range of mountains containing a few active and many inactive volcanoes. Between the mountains and the Pacific Ocean there is a narrow strip of land consisting of foothills and coastal plains, which is crossed by all of the streams flowing west and having their sources in the Continental Divide. Principal of these are the La Paz, which forms in part the boundary between El Salvador and Guate-

mala; the Margarita; the Aguacapa; the Guacolate; the Covolate; the Madre Vieja; the Nagualate; the Sancala; the Naranjo; the Cabus; and the Suchiate, which forms in part the boundary between Guatemala and Mexico. All of these streams descend precipitously and are usually in deep ravines until reaching the lowlands along the coast.

Drainage from the central plateau to the Atlantic Ocean is principally carried by the Rio Motagua with its tributaries, the Rios Grande and Chiquimula, and the Rio Usumacinta with its tributaries, the Rios Salinas and de la Pasion. The Rios Motagua and Usumacinta have sources in the department of El Quiché near Santa Cruz Quiché. The former flows almost due east and then bears slightly north of east before reaching the sea. The latter flows slightly north of west, thence due east, and finally north and northwest. The Rio Polochic is another important stream flowing into the Gulf of Honduras, as is the Rio Usumacinta, flowing through Mexico into Campeche Bay.

Interesting among the volcanoes are Acateño, Agua, and Fuego which, standing in close proximity to each other, present a magnificent spectacle. Acateño rises to an elevation of 13,100 feet, while Fuego and Agua are only slightly lower. In all, there are 18 volcanic cones easily identifiable in the range forming the southern rim of the central plateau.

The volcano Santa María, near Quezaltenango, became active in 1902, and at that time a large section of the southern side of the peak was blown away and the country for miles around was covered with volcanic ash.

Although there are several volcanoes that smoke continuously, the severe disturbances, accompanied by the emission of lava, which spread destruction throughout the country are infrequent. Earthquakes of minor severity occur often, but long intervals of time have heretofore elapsed between those of a destructive nature.

CLIMATE AND RAINFALL

The climate of Guatemala varies from tropical along the Atlantic and Pacific coasts to temperate in the interior mountainous sections. The temperature varies along the coasts from 80° to 95° F. and in the higher altitudes from 50° to 75° F. Occasionally the thermometer falls below freezing at points along the roads in the more elevated sections.

There are two seasons prevailing throughout the Republic—the wet season, which extends from May to December, and the dry season during the remaining months of the year.

It rains almost daily during the height of the wet season, August to November. The maximum rainfall occurs on the Atlantic side, and it is interesting to note that the average annual rainfall at Livingston on the Atlantic Ocean over a period of 3 years was 198.92

inches, while at Quezaltenango near the Continental Divide at an elevation of 7,710 feet it was 28.19 inches over a period of 4 years. At Guatemala City near the Divide and at an elevation of 4,855 feet it was 51.84 inches over a period of 29 years. At San José on the Pacific Ocean it was 55.80 inches over a period of 3 years.

POPULATION

No official census of Guatemala has been taken since 1921. The economic depression postponed the census scheduled for 1931. The official estimate of population as of December 31, 1930, was 2,163,546, an increase of nearly 8 percent over 1921 which, in turn, showed an increase of almost one third over 1893. By departments the population in 1921 was distributed as shown in table 1, in round numbers.

TABLE 1.—Population, by Departments, in 1921

Alta Verapaz	161,000
Amatitlán	38,000
Baja Verapaz	69,000
Chimaltenango	88,000
Chiquimula	94,000
Escuintla	59,000
Guatemala	217,000
Huehuetenango	137,000
Izabal	20,000
Jalapa	43,000
Jutiapa	94,000
Peten	8,000
Quezaltenango	169,000
Quiché	138,000
Retalhuleu	37,000
Sacatepequez	46,000
San Marcos	176,000
Santa Rosa	81,000
Solola	104,000
Suchitepequez	65,000
Totonicapán	94,000
Zapaca	66,000
Total	2,004,000

Table 2 gives the cities and towns which, including the surrounding populations served by them (municipalities), have a population in excess of 5,000. Round numbers are used. Those marked "(x)" are the capitals of their respective departments.

In 1931 there were over 10,000 foreigners registered at the Guatemala Foreign Office, of which nearly 10 percent were Americans, 27 percent Mexicans, 19 percent English, and 17 percent Germans. Twenty-four countries of Europe were represented, their total being 60 percent of the foreign population registered. According to a study made by Señor Diego Polanco, Director of the National Statistical Bureau of Guatemala, the racial divisions of the population show ladinos (white and Indian mixture) nearly 34 percent, Indians almost 65 percent, whites less than 1 percent, and a few negroids and orientals. Ninety-one percent of the whites are in the department of Guatemala.

The 1921 census classified the population as 27 percent urban and 73 percent rural. According to a study and report made by the United States military attaché in 1926, from 75 to 80 percent of the population was engaged in agricultural pursuits. Figures indicating the number engaged in livestock raising, mining, and manufacturing are not available.

TABLE 2.—*Cities and towns with a population in excess of 5,000 in 1921*

City	Population		Department
	City proper	Municipality	
Amatitlan (x).....	3,000	7,000	Amatitlan.
Antigua (x).....	5,000	11,000	Sacatepequez.
Asuncion Mita.....	3,000	14,000	Jutiapa.
Ayutla.....	1,000	14,000	San Marcos.
Barberena.....	1,000	11,000	Santa Rosa.
Cantel.....	2,000	7,000	Quezaltenango.
Cahabon.....	400	11,000	Alta Verapaz.
Coatepeque.....	3,000	16,000	Quezaltenango.
Coban (x).....	5,000	27,000	Alta Verapaz.
Colomba.....	400	30,000	Quezaltenango.
San Cristobal.....	2,000	12,000	Alta Verapaz.
San Cristobal.....	2,000	11,000	Totonicapan.
Cuillapa (x).....	2,000	6,000	Santa Rosa.
Cuyotenango.....	1,000	8,000	Suchitepequez.
Chichicastenango.....	1,000	25,000	Quiche.
Chimaltenango (x).....	4,000	6,000	Chimaltenango.
Chiquimula (x).....	5,000	20,000	Chiquimula.
Escuintla (x).....	5,000	22,000	Escuintla.
Esquipulas.....	1,000	7,000	Chiquimula.
San Felipe.....	1,000	9,000	Retalhuleu.
Gualan.....	1,000	13,000	Zacapa.
Guatemala (x).....	115,000	121,000	Guatemala.
Huehuetenango (x).....	4,000	10,000	Huehuetenango.
Jalapa (x).....	4,000	15,000	Jalapa.
Jutiapa (x).....	3,000	19,000	Jutiapa.
Livingston.....	2,000	5,000	Izabal.
San Lucas Toliman.....	3,000	6,000	Solola.
Malacatan.....	1,000	15,000	San Marcos.
San Marcos (x).....	3,000	6,000	Do.
Mataquescuintla.....	2,000	8,000	Santa Rosa.
Mazatenango (x).....	5,000	11,000	Suchitepequez.
Mixco.....	3,000	9,000	Guatemala.
Momostenango.....	10,000	26,000	Totonicapan.
Morazan.....	500	5,000	Baja Verapaz.
San Juan Ostuncalco.....	2,000	10,000	Quezaltenango.
Patzia.....	4,000	5,000	Chimaltenango.
Patulul.....	1,000	10,000	Solola.
Patzun.....	5,000	10,000	Chimaltenango.
San Pedro Sacatepequez.....	4,000	13,000	San Marcos.
San Jose Pinula.....	2,000	8,000	Guatemala.
Quezaltenango (x).....	19,000	30,000	Quezaltenango.
Santa Cruz Quiche (x).....	3,000	17,000	Quiche.
Rabinal.....	2,000	12,000	Baja Verapaz.
Retalhuleu (x).....	3,000	14,000	Retalhuleu.
Salama (x).....	3,000	14,000	Baja Verapaz.
San Carlos Sija.....	400	6,000	Quezaltenango.
Solola (x).....	3,000	11,000	Solola.
Tecpan.....	3,000	9,000	Chimaltenango.
Totonicapan (x).....	4,000	30,000	Totonicapan.
Tumbador.....	400	14,000	San Marcos.
Zacapa (x).....	5,000	18,000	Zacapa.

¹ Estimate Dec. 31, 1931, was 141,000.

ECONOMIC SECTION

National wealth and income.—Conflicting data—in some instances complete lack of authentic information, private or official—the wide variation in wages and allowances in different sections of the country, the relatively large extensions of territory, like Peten of which little is known, tribal isolations, and general lack of acquaintance even by the natives themselves with the resources and conditions of their country, make it exceedingly difficult to hazard even so much as a guess as to the national wealth and income of Guatemala. Hence, estimates herein given must some day be revised.

The character of the dwellings and business places, the numerous cities, the super-excellence in cultivation and embellishment of coffee plantations, the many

recorded but unexplored mineral and timber regions, the progress in the use of nearly all the paraphernalia of 20th century life and the general well-being of the inhabitants, numbering about one-third of the aggregate population of Central America, all point to the fact that the national wealth of Guatemala exceeds to a considerable degree that of any other Central American republic. Probably \$400,000,000 would not be too high a figure to accept as the gross national wealth of the country, from which might be subtracted about \$100,000,000 for foreign investments in Guatemalan enterprises, and about \$20,000,000 of external obligations, leaving a net wealth of \$280,000,000.

Employment and wages.—Wages vary greatly in different sections of the country. A “colono” (tenant farmer) family on the west coast normally has a cash income of \$40 to \$50 a year; a highland family about \$10 less. Coffee plantations on the Pacific coast paid an average of 20 cents a day or task for labor, a reduction of 5 to 10 cents below 1929. In addition to money wages the laborers receive salt, corn, lime (for leeching the corn), and medicines. Eastern Departments have a wage scale about 10 cents lower, but large tracts of land are given to laborers for planting and augmentation of income. The wage scale in the Coban district for plantation labor is 5 to 8½ cents. Road workers at present receive 33⅓ cents a day. These may be classed as rural workers.

Laborers on the north coast in the banana district receive relatively high pay. They are chiefly Jamaica negroes. Normally their wages run from \$1.50 to \$2 a day.

Engineers on the International Railways were receiving \$150 a month; conductors \$100 to \$165; shopmen \$2 to \$5 a day; track and maintenance laborers, 75 cents to \$1. Necessary economies resulted in some reductions in these wages last year.

Construction laborers in Guatemala City in normal times receive from 50 cents to \$2 a day; masons, \$1; assistant masons, 50 cents; carpenters and structural steel workers, \$2.

Contractors state that labor in Guatemala represents about the same percentage of the completed cost as in the United States since the lower scale is offset by lower daily output. The law provides for a 48-hour week and 75 percent of all laborers in any enterprise must be Guatemalan. The discharge of an employee ordinarily necessitates a month's notice or a month's pay.

PRODUCTS AND INDUSTRIES

AGRICULTURE

The extent to which Guatemala is dependent upon agriculture is evinced by the fact that normally 93 percent of its exports consists of farm products. A 6-year export average, 1925–30 inclusive, shows that of Guatemala's total exports, coffee accounted for over 78 percent, bananas 10½ percent, and sugar 3.7 per-

cent. Cattle products amounted to but 1 percent, forest products slightly over 4 percent, and mineral products but two-tenths of 1 percent of the total.

Coffee.—This is the basic, or “money” crop of Guatemala, and the whole economic life of the country rises or declines with it. Coffee became the primary source of Guatemala’s wealth between 1870 and 1880 when export reached an annual average of 20,000,000 pounds. Production doubled in the 1880–90 decade, and exceeded an annual average of 60,000,000 pounds before the end of the century. Production and export have steadily increased since 1900, exports now approximating 100,000,000 pounds annually, but the price has fluctuated from a high of about 25 cents a pound in 1929 to a low of about 5 cents in 1933, at the plantation. There is a very close relationship between the price which Guatemala receives for its exported coffee and the total value of its imports. It is the consensus of opinion in Guatemala that Brazilian competition has permanently eliminated low-grown coffee as a profitable enterprise, but the quality or high-altitude coffees should continue to enjoy a lucrative market with the return of normal conditions. Table 3 shows exports of coffee for the 5-year period 1928–32, inclusive.

TABLE 3.—*Coffee exportation, 1928–32*

Calendar year:	Pounds
1928-----	98, 042, 000
1929-----	97, 383, 000
1930-----	125, 674, 000
1931-----	75, 424, 000
1932-----	97, 441, 000
Total-----	493, 964, 000

In addition to the amount exported, about 12,000,000 pounds is domestically consumed, according to the Guatemalan director of statistics. This would indicate a total production of from 110,000,000 to 115,000,000 pounds annually. Percentage production by departments is approximately as given in table 4.

The prediction of coffee growers in Guatemala is that the production of low-grown coffees will be abandoned, while that of high-grown will continue to increase. There are still many thousands of acres of land suitable for coffee growing, much of it inaccessible at present for lack of highways.

In 1913 the United States took about 23 percent of Guatemala’s exports of coffee; during the World War about 69 percent; from 1919 to 1923 about 75 percent, after which there was a steady decline to 32 percent in 1930, rising to 35 percent in 1932–33 when Brazilian exports were hampered.

Bananas.—The United Fruit Co. started banana operations in Guatemala in 1905. For the 22-year period 1908–1929, inclusive, 76,683,000 stems of bananas have been exported of which the company produced 80 percent, 20 percent being produced by

independent concerns. Salaries and wages paid out in that period totaled over \$31,000,000. The main producing area at present is in the Motagua Valley.

TABLE 4.—*Percentage production of coffee*

Department:	Percentage of total
San Marcos-----	19
Quezaltenango-----	14
Retalhuleu-----	2½
Suchitepequez-----	9
Solola-----	14
Chimaltenango-----	8
Escuintla-----	7
Sacatepequez-----	4
Santa Rosa-----	8
Amatitlan-----	2½
Alta Verapaz-----	9
Scattering-----	3
Total-----	100

There are some smaller independent establishments in the Polochic Valley and around Lake Izabal. These independents sell to the American company. Prior to the depression this company was in process of developing an estimated 12-million-stem area on the Pacific coast not far from Champerico, and quite recently some activity was reported in that area looking to a resumption of development. Exports of bananas for the 5-year period 1928–32, inclusive, were as given in table 5.

The United States takes about 90 percent of Guatemala’s bananas, and 10 percent goes to England and France.

TABLE 5.—*Banana exportation, 1928–32*

	Number of stems
1928-----	6, 192, 667
1929-----	6, 424, 633
1930-----	4, 874, 302
1931-----	4, 153, 000
1932-----	3, 329, 602
Total-----	24, 973, 602

Corn.—In the economy of Guatemala corn ranks first, not as an article of foreign commerce but as the principal item in the national diet. It is very difficult to determine from available statistics just what is the corn production of Guatemala. The Guatemalan Department of Agriculture places the average annual production for the period 1923–30 at 237,000,000 pounds, while the Guatemalan Statistical Bureau estimates an average of 608,000,000 for that period, based on a daily per capita consumption of eight-tenths of a pound and normally little or no importation. During 1933, as a result of insufficient crop, Guatemala was obliged to import a considerable quantity of corn, much of which came from Nicaragua. Grown under the most primitive conditions, it thrives in all parts of Guatemala from sea level to 10,000 feet altitude. It is estimated that 95 percent of the rural planters raise

corn and there has been little or no change in methods since the days before the conquest. Two crops a year are grown on the coastal plains and one in the highlands.

Due to lack of communication with the Indian country (highlands) the occasional failure or insufficiency of the lowland crops makes importation necessary. Already there is a trend toward linking the Guatemala national highway with these highland regions and the completion of the inter-American highway, of which the national highway would be a constituent part, would greatly stimulate construction of these subsidiary roads, thereby enabling the country to become self-sufficient in corn, beans, and many other agricultural products. The varieties of corn grown are yellow, "obispo", red, black, and white, the last named being devoted chiefly to the making of chicha, a native beverage.

Sugar.—Two types of sugar are produced, white and panela, or raw brown; the former being a refined product of high polarization restricted to the Departments of Escuintla and Solola, while the latter is primitively manufactured in every department of the Republic. The 3-year average of white-sugar production, 1927–30, was about 24,000 short tons, of which two-thirds was sold locally. Export showed a high of over 13,000 tons in 1923, of which the United States took 43 percent, dwindling to 2,700 tons in 1930, the United States taking none. A refiners' agreement now holds production to domestic consumption requirements, or about 15,000 tons. There are 11 mills in operation. The Department of Agriculture of Guatemala estimated the production of panela for 1930–31 to be 29,000 short tons.

Wheat.—The average production of this grain from 1925 to 1930 was about 177,000 bushels annually, and acreage planted was nearly 21,000. Guatemala wheat is grown from seed originally imported, but there has been some degeneracy, the heads now bearing but a few grains. The largest plantings are found in the departments of San Marcos, Quezaltenango, Totonicapan, and Chimaltenango. Smaller areas are found in Quiche, Huehuetenango, and Solola. Production has advanced little beyond the most primitive stage. Seventy-three flour mills in 1929 produced 3,800 tons of flour and 1,200 tons of bran. Scientific methods of cultivation and efficient milling would greatly increase wheat production. Guatemala annually imports an average of 150,000 barrels of flour, all from the United States.

Beans.—Next to corn, beans form the staple national diet of Guatemala. According to the department of agriculture, production for the period 1923–30 averaged nearly 11,000,000 pounds, grown on 26,000 acres of land. The director of statistics, however, estimates annual consumption to be over 90,000,000 pounds, or approximately 45 pounds per capita,

which is probably nearer the actual production.¹ Beans are grown in every one of the 22 departments. White, red, and black beans are grown, the third variety being that most generally eaten.

Cotton.—In 1924–25 Guatemala produced 3,500,000 pounds of unginned cotton, good middling. According to the department of agriculture, production had fallen in 1931 to 700,000 pounds. Seventy percent is raised in the Department of San Marcos. A brown variety introduced from Peru is also grown to some extent. The ravages of the locust have discouraged cotton growing.

Rice.—This is a popular article of diet among the ladinos. Consumption is estimated to be about 7,500,000 pounds a year, of which one-third to one-half is domestically produced and the remainder imported. The largest production is recorded in the Departments of Santa Rosa, Jutiapa, and Suchitepequez. The total acreage in 1930 was slightly under 5,000. Here is a commodity which, given adequate transportation facilities, could be developed to a point permitting large exportation. Some rice is grown in the practically undeveloped Department of Peten. The present Guatemalan administration has for some time been eager to construct a highway from the capital to Peten, and the colonization of that department has been in contemplation, with the possibilities of rice as the base crop being considered. The soil in the Peten region is an extension of that in British Honduras, and rice grown in the latter country is said to be superior to oriental rice. It created a furor at the British Empire Exposition some years ago.

Other agricultural commodities which offer possibilities in Guatemala, with figures for production in 1931 quoted from the Department of Agriculture, are shown in table 6.

President Ubico has been making some interesting experiments on his plantation in growing ramie. Soil and climate give 3 to 4 heavy crops a year, and should ramie become an important commercial fiber, Guatemala is ideally adapted to its production.

TABLE 6.—*Production figures of certain commodities in 1931*

	Quintals
Potatoes.....	27, 800
Casava (green).....	9, 000
Oats.....	1, 700
Cacao.....	2, 800
Cardamon seed.....	136
Maguey (henequen).....	634
Tobacco ²	1, 600

¹ The ministry of agriculture bases its production figures on information supplied by officials in the various departments or provinces, some of whom report after careful investigation, while some make guesses, and some fail to report at all. The statistical bureau, where figures are lacking, bases estimates on known per capita consumption and importation.

² The British American Co. is endeavoring to stimulate interest in tobacco growing. Much of the tobacco used in the manufacture of cigars and cigarettes is imported from Honduras.

Fruits.—Practically all the fruits common to tropical regions are to be found in Guatemala, and in the highlands many of the temperate zone fruits are grown and would do well if scientifically cultivated. Many of these fruits, such as peaches, apples, and grapes were introduced by the Spaniards in early days, as was also the Valencia orange now grown in quantity in the Rabinal region. The flavor of the Rabinal orange is second to none, notwithstanding haphazard cultivation. Grapefruit production presents great possibilities. All citrus fruits do well and production could be greatly increased if highway communications were improved and a wider market opened. Other fruits deserving mention are the pineapple, cashew (nut), custard apple, crab apple, rose apple, sapodilla, breadfruit, papaya, quince, fig, strawberry, avocado, guava, pomegranate, blackberry, and many others less known.

Among the essential oils which can be, and to some extent are, produced in Guatemala are citronella, exports of which have at times run from 3,000 to 8,000 pounds annually; lemon grass, now produced commercially in the Department of Escuintla; eucalyptus from which one plantation owner claims to have facilities for producing 75,000 pounds of oil a year; and bay oil. The American commercial attaché in Guatemala in a report states:

The abundance of native essential oil botanicals and crude drug plants might merit the investigation of American distilling interests.

Among other sources of essential oils he mentions almond, anis, argemone, arnica, cassia, chamomile, cumin, cypress, fennel, laurel, lavender, marjoram, myrtle, peppermint, valerian, and wormwood.

Pacheco, in his "Plantas Reputadas Medicinales" lists 831 medicinal plants common in Guatemala.

A German in the vicinity of Coban has had good success in growing tea, which apparently will do well in the highlands where cheap Indian labor is available. The possibility, even though it may be somewhat remote, of one day looking to Guatemala as a source for hard rice and tea, is worthy of serious consideration.

To quote from a report of the former United States Commercial Attaché to Guatemala:

There are still great areas of fertile land which cannot be economically utilized on a commercial scale for lack of transportation.

But the sections with the greatest density of population are well served and with the incorporation of the national highway into the inter-American highway system, much more attention will be paid to lateral lines extending into these undeveloped areas.

Timber resources.—It is estimated that between 60 and 65 percent of the total area of Guatemala is under forest, yet forest products account for only about 4 percent of the country's export trade. This is due chiefly to the fact that stumpage areas are inaccessible.

The Department of Peten, for example, with an area of 13,500 square miles is nearly all forest and according to Tom Gill (Tropical Forests of the Caribbean), "one of the finest hardwood areas in tropical America." At present the only outlets for Peten are streams flowing through Mexico and British Honduras. Alta Verapaz and Izabal and portions of Quiche and Huehuetenango are largely covered with forests. The plateaus in the mountainous section are treeless as a rule, but the ranges are covered with coniferous forests.

Gill estimates approximately 18,000,000 acres of forests in Guatemala, of which 15,000,000 acres are hardwoods and 3,000,000 acres are softwoods. The hardwoods—pine, cedar, cypress, and some oak—predominate in the highlands. Lumber cutting in normal times has been estimated at 12,000,000 boardfeet a year; cuttings for clearing, fuel wood, fence posts, etc., account for 20,000,000 cubic feet.³ The greatest loss of lumber comes from the immemorial custom of the Indians burning off patches of forests for crop lands.

Mahogany is the principal wood exported, the bulk of it cut on the Pacific coast. A lighter colored, somewhat softer variety grows in Peten. About half the Pacific forest area remains standing, a belt 15 to 25 miles wide, extending from the Mexican to the Salvadorean border. Prior to the depression, cuttings in this area were estimated to be from 3,500,000 to 6,500,000 feet annually, of which about 30 percent was consumed in the domestic market. Lumber cruisers have estimated 25,000,000 feet of commercially available timber in this area. The actual amount is much greater, but the stands are scattered.

Operations in Peten are confined to the river regions, the Usumacinta, Salinas, and Pasion. The mahogany is dragged to the rivers by oxen or tractors and floated to Tenosique when the rivers flood. Here the logs are rafted and floated on to Frontera, Mexico, for export. The northeastern section of Peten ships by way of the Rio Belize through British Honduras. The Peten forests are on national lands, as are those in the remote districts of Alta Verapaz and Izabal. By Legislative Decree No. 1731, May 29, 1931, the executive is authorized to enter into contracts for the exploitation of the national forests. These contracts are subject to certain conditions such as public auction, a minimum guaranteed output, and legislative approval of the contract.

Next to mahogany in commercial importance is Spanish cedar, statistics concerning the amount and locations of which are lacking. It is extensively used domestically.

Pine is found in the mountain ranges in all parts of the Republic, the largest commercial cuttings being on the southern slopes of the Sierra de las Minas range

³ Forest Resources of the World, by Raphael Zen and William M. Sparhawk, McGraw Hill Book Co.

back of El Jicaro on the International Railway, and on the Caribbean slopes of the Cordillera de los Andes in the Department of Jalapa. Yellow pine grows from 2,500 to 4,000 feet elevation; a pine similar to the "ponderosa" of western United States grows at 4,000 to 6,500 feet elevation. Superior cedar is also found in the higher elevations.

There are a great many rare woods found in the lower elevations, but stands are too scattered to permit them to be commercially important. Nogal, a beautiful variety of walnut, cocobolo, nazarena, matilisquate, and rosewood are worthy of mention.

In 1925 Guatemala exported nearly 13,000,000 board feet of lumber, chiefly mahogany and cedar. In 1929, exports totaled 17,367,000 feet, dropping to 4,400,000 feet in 1930 and about the same quantity in 1931.

It is a commentary on lack of highway communications in Guatemala that Douglas fir and Oregon pine can be sold in limited quantities in Guatemala markets for about the same price as the domestic pine, due to the expense of getting the latter to local markets. The inter-American highway will do much to cheapen the cost of getting lumber to domestic and export markets.

Among the forest products, chicle takes first rank. This is the base for American chewing gum. The trees are isolated and found in the most remote regions of the country, particularly in Peten. No accurate statistics are available as to the actual amount of chicle exported from Guatemala. The great difficulty of guarding the frontiers of Mexico and British Honduras and the export tax on chicle encourage smuggling. Peten export is estimated at 625 tons. Some chicle is credited to Alta Verapaz, Jutiapa, and Retalhuleu. In all the country probably exports about 700 to 1,000 tons annually.

Other forest products are vanilla, sarsaparilla, many medicinal barks, and herbs. Camphor and cinnamon trees have been introduced and thrive, and near Chimaltenango there is said to be a small cinchona (quinine) development.

Spices of all kinds grow well. Oil-yielding palms, coconut, cohune, and corozza flourish. Castilla rubber grows wild. At Velasquez on the Pacific coast there is a plantation of 50,000 rubber trees. Export has become inappreciable due to East Indian competition, but the natives make use of rubber in the fabrication of raincoats and hats.

Mangrove grows luxuriantly on both coasts. This yields a tannin for processing leather. A type of divi-divi is found in large quantities. Icaco (*coccoloba*) and ron-ron are found.

The development and exploitation of many of these forest products is deserving of careful study and the Guatemala Government would undoubtedly cooperate in such an investigation.

Stock raising.—The chief cattle-raising section of Guatemala is along the Pacific coast from the Mexican to the Salvadorean frontiers. Statements as to the number of head vary greatly. Reports of stock raisers to the Department of Agriculture have been as shown in table 7.

In 1925 a special commission named by the Department of Agriculture made a livestock census and found 555,729 head compared with 238,138 reported by stockmen. Guatemala "criollo" stock averages 950 to 1,000 pounds weight. It has been bred with Zebus, Durhams, and Herefords. Many good breeding bulls have been imported from the United States. Texas stock is the most suitable. There are over 40,000 milch cows. The production of milk, butter, and cheese varies greatly from year to year: Milk from 9 to 15 million liters; butter, 250,000 to 374,000 pounds; cheese 1,400,000 to 1,900,000 pounds. Here again the inter-American highway would be of great aid in getting cattle and cattle products to market.

The chief sheep-raising sections are in the western highlands—Departments of Huehuetanango, San Marcos, Quezaltenango, Totonicapan, and Quiche. Between 180,000 and 200,000 head are raised and the annual wool yield averaged 3 pounds an animal. Merinos introduced many years ago have degenerated and are raised principally for mutton.

TABLE 7.—*Reports of stockraisers to the Department of Agriculture*

	Head
1927-----	310, 168
1928-----	243, 764
1929-----	396, 162
1930-----	289, 796
1931-----	387, 407

Other livestock reported by the Department of Agriculture in 1931 were:

Horses-----	56, 523
Mules and asses-----	34, 065
Hogs-----	87, 491
Goats-----	16, 206

Every Indian raises a few chickens, and some of the plantations raise blooded strains which do well. The markets are always plentifully supplied with poultry and eggs.

Apiculture has made good progress since it was taken up on a commercial scale at the beginning of the century. Guatemala honey is an exceptionally fine product, the best producing regions being in the departments of Escuintla, Santa Rosa, Sacatepequez, Chimaltenango, Retalhuleu, and Suchitepequez. Average annual export for the 5-year period 1926-30 totaled 1,800,000 pounds, Germany taking most of it.

Fishing continues to be an individual enterprise. The capital is constantly supplied with fresh fish from both coasts. Off the many keys in the Caribbean the fishing grounds are excellent. An abundance of cray-

fish is found. Bêche de mer (trepang) has been reported in this vicinity. The lakes and streams provide fair sport. Recently Amatitlan and Atitlan, the two principal lakes, were stocked with land-locked salmon sent from the United States.

The Office of Agricultural Statistics gives the data shown in table 8 with respect to distribution of privately owned lands, a manzana equaling nearly $1\frac{3}{4}$ acres.

TABLE 8.—Distribution of privately owned lands in manzanas

Department	Total private property	Under cultivation	Uncultivated land	Forested land	Property in grazing land
Guatemala.....	193,974	27,998	57,325	38,474	70,177
Sacatepeque.....	32,876	10,631	11,694	5,839	4,712
Chimaltenango.....	141,255	40,093	44,361	25,676	31,125
Escuintla.....	426,189	40,835	143,276	142,226	99,852
Amatitlan.....	69,489	15,529	20,319	11,064	22,577
Santa Rosa.....	177,964	24,474	46,090	29,373	78,027
Jutiapa.....	235,828	15,338	180,799	8,790	30,901
Jalapa.....	75,834	9,260	27,868	6,791	31,915
Chiquimula.....	33,118	3,379	6,329	5,025	18,385
Zacapa.....	95,822	4,865	47,731	16,997	26,229
Izabal.....	42,316	11,424	10,158	14,350	6,406
Baja Verapaz.....	122,158	13,778	51,160	37,797	19,423
Alta Verapaz.....	645,554	99,550	296,766	217,296	31,942
Peten.....	9,383	1,874	3,515	1,781	2,213
Quiche.....	191,724	21,762	46,236	51,035	72,691
Huehuetenango.....	390,524	39,542	159,900	115,135	75,947
Totonicapan.....	16,644	13,207	2,850	276	311
San Marcos.....	152,394	39,182	60,330	23,515	29,367
Quezaltenango.....	154,801	36,443	78,601	-----	39,757
Retalhuleu.....	159,425	12,792	65,359	36,035	45,239
Suchitepequez.....	147,239	30,405	27,262	71,812	17,760
Solola.....	283,268	27,294	167,295	51,547	37,132
Total.....	3,797,779	539,655	1,555,224	910,814	792,088
Equivalent in acres.....	6,604,337	938,461	2,704,532	1,583,903	1,377,441

The Ministry of Agriculture reports 7,427 native landowners holding 2,511,780 acres in 1930-31, and 812 foreign landowners holding 1,092,995 acres. Small holders totaled 38,679 acres. These are recorded properties. Little is known as to the acreage used by Indian squatters for crop and cattle raising.

MINING

Gold.—Between 1529 and the middle of the eighteenth century gold mines are reported to have been found near San Martin Jilotepeque, the Cerro de Jumay, Rabinal, and the Rio de los Plantanos. No veins have been worked, so far as is known, for a century but considerable placer mining has been carried on. About 30 miles from Puerto Barrios, and located on the Rio Bobos in the foothills of the Merendon Mountains, are Las Quebradas gold mines. The property connects with the International Railways of Central America by a spur line belonging to the United Fruit Co. It is a placer running 25 to 50 cents per cubic meter. Gold production for the 5-year period 1927-31, inclusive, averaged 10,695 fine ounces a year. Nearly all of it was dredged.

Silver.—About 70 years ago a British company operated extensively in the Department of Chiquimula, taking out 50,000,000 ounces of silver. Silver claims were filed, 1773-1862, on properties near Tecpam and Comalapa, Department of Chimaltenango; in the Ermita Valley, Department of Guatemala; and in Cerro de Carizal near San Martin Jilotepeque. The

last production reported was 1,300 grams in 1930 from a mine opened in San Juan Sacatepequez.

Quicksilver.—Various statements as to the existence of this mineral have been received by the national government, and a number of claims have been filed to exploit quicksilver. It is reported to exist in the Cuchumatanes Mountains east of Huehuetenango, but the Indians inhabiting that section are said to be averse to having the mines developed.

Copper.—Veins have been located in the western part of the Department of Baja Verapaz near the town of Rabinal. The International Railways owns a number of claims near Concepcion, Department of Chiquimula. Large deposits of lead and zinc, containing silver and copper, are reported to exist, but they are at present inaccessible. Copper has been located near Chiantla, Department of Huehuetenango. No copper production has been reported recently.

Zinc.—Important deposits have been located in the Department of Chiquimula, near Concepcion. These have been taken over by the International Railways, and the properties will be exploited when conditions improve. There is another deposit near Alotepeque in the same Department.

Lead.—This is found principally in the western section in the Department of Huehuetenango. In 1928, 17 mines were reported in operation, producing 291,000 pounds. One of these was in Alta Verapaz, the rest in Huehuetenango. In 1930, 11 mines produced 376,000 pounds of lead.

Coal.—About the middle of the last century claims were filed on lignite in Chimaltenango, anthracite in Livingston, and bituminous coal in Mina de la Serrana. Other reported deposits are at Bahia de Santo Tomas, and at Bodegas, in the Department of Livingston. A claim was filed in 1931 covering a mine in Sacatepequez.

Chromite.—In 1916 a bed of chromite ore was discovered in the Department of Jalapa. It runs 54 percent chrome oxide. The mine belongs to the International Railways of Central America and is worked by the Vanadium Corporation of America under lease. During the current year there was considerable activity at this mine, which is not far from the railroad. All shipments are to the United States.

Gypsum.—Sierra del Merendon is reported to be rich in gypsum, but lack of transportation facilities has made working unprofitable.

Marble.—In the hills northwest of Zacapa is a quarry of pure white marble formerly operated by the Guatemala Marble & Granite Co. A 16-mile branch line connects the quarry with the International Railways. About 500 tons of this marble were exported to the United States in 1924 and 1925, but of recent years export has been inappreciable.

Mica.—Substantial quantities of mica have been found in the Departments of Quiche and Chimaltenango.

It comes in large sheets and considerable was exported to the United States in 1917 and 1918. In 1922 only four mines were reported, all in the Department of Alta Verapaz and all American controlled. It is reported that the combined deposits of Verapaz and Quiche extend over an area 25 miles long and 10 miles wide. It is of the dark green variety. Rose and brown mica have been reported in Huehuetenango.

Limestone.—This is found in enormous quantities in many parts of the country. It is frequently found with a silicious volcanic ash which can be roasted with the lime for the production of cement.

Niter.—This is found in numerous parts of Guatemala. The principal deposits are along the lower reaches of the Motagua Valley as far as Zacapa.

Salt.—This has long been produced on the Pacific coast. Large salt works are located at San Jose and Champerico. Both the boiling and the evaporation processes are used.

Petroleum.—No oil finds worth mentioning have been reported, although there has been some search for it. Petroleum seepages are reported in El Peten, which Department is believed to offer the most interest to the oil seeker. Highly inflammable bitumen which burns with a blue flame is said to saturate the lower cretaceous limestone beds near Coban.

Due to inaccessibility, many mineral fields in Guatemala have not been thoroughly studied. Doubtless some exist which are not even known. Subsidiary roads which should eventually follow the construction of the inter-American highway would make a number of mining areas much more available for investigation.

WATER POWER

No adequate survey of the potential water power of Guatemala has been made. On page 38 of the World Atlas of Commercial Geology, published by the United States Geological Survey in 1921, it is stated that in 1920 the developed water power of Guatemala was 4,000 horsepower, while the potential horsepower was 1,500,000. Opinions of electrical engineers are to the effect that exclusive of Peten the wet season potential horsepower is 150,000 and 100,000 in dry season. The total installed electric generator capacity in 1932 is given by the United States commercial attaché, after a careful check, as shown in table 9.

TABLE 9.—*Installed electric generator capacity in 1932*

Type	Known kilo- watts	Esti- mated kilo- watts ¹	Total
Water power.....	17, 240	3, 000	20, 240
Diesel.....	209		209
Steam.....	512		512
Other ²		270	270
Total.....	17, 961	3, 270	21, 231

¹ Plantation installation.

² Self-contained lighting plants.

MANUFACTURING

No industrial census, not even an industrial survey, is available. The largest individual manufacturing plants in the country are El Cantel, near Quezaltenango a cotton factory operating 13,000 spindles; 2 fair-sized breweries, 1 in the capital and 1 in Quezaltenango; a cement factory near the capital belonging to Novella & Co., capacity 120 tons daily; and the cigarette factory of Tabacalera Nacional. There are 3 hosiery factories, 11 sugar refineries, 73 flour mills, 30 beverage factories, 6 soap factories, and a large number of alcohol distilleries. Grouped under commodities, the following products are manufactured in the country:

Beverages: Rum, beer, soft drinks.

Building materials: Cement, tile, brick, lime, concrete pipe, lumber.

Chemicals: Pharmaceutical specialties, toilet preparations, acids, sulphates, medicaments.

Foodstuffs: Refined sugar, flour, butter, cheese, sausage, candy, baking products, jellies, chocolate, coffee, sirups.

Furniture and fixtures: Beds, chairs, wardrobes, etc.

Leather: Boots and shoes, saddlery, and miscellaneous.

Lumber: Sawmill and finishing mill products.

Textiles: Hosiery, yarns, sheeting, calicoes, drills, knit goods, towels, suiting, working clothes, shirts, blankets.

Tobacco: Cigarettes and cigars.

Miscellaneous: Candles, ice, cordage, hats, raincoats, mattresses, essential oils, printing and lithographing, chewing gum, shoe polish, and a few others.

With the exception of those mentioned in the first paragraph, these are all very small industries employing from 2 to 10 hands. Nearly every Indian family is engaged in home handicrafts such as textile spinning and weaving, pottery making, and the like.

TRANSPORTATION AND COMMUNICATION

Ocean transport.—United States Commercial Attaché Mervin L. Bohan observes that—

Guatemala is well provided with marine transportation facilities. Four ports give it short-haul outlets and every part of the Republic, with the exception of Peten and certain outlying portions of Alta Verapaz, Quiche, Huehuetenango, and San Marcos, can be said to be adequately served, or will be when the present road system advances to the stage where it can be utilized throughout the year.

Guatemala has 4 ports, 2 on the Pacific and 2 on the Atlantic. The annual average export and import tonnage of these ports over the 10-year period 1921–30 was as shown in table 10, taken from Guatemalan official sources.

It will be noted that Puerto Barrios handled 67 percent of the export and over 73 percent of the import tonnage.

About 45 percent of the vessel tonnage calling at Guatemalan ports is American, and American vessels carry from 50 to 75 percent of Guatemala's imports, 50 percent of the exports, and nearly 75 percent of the passengers arriving and departing.

TABLE 10.—*Annual average export and import tonnage, 1921-30, for the ports shown*

Port	Export tons	Import tons	Total tons
Puerto Barrios	94, 000	168, 000	262, 000
San Jose	25, 000	28, 000	53, 000
Champerico	17, 000	19, 000	36, 000
Livingston	4, 000	14, 000	18, 000
Total	140, 000	229, 000	369, 000

Puerto Barrios is equipped with a concrete wharf 1,090 by 90 feet, with a 1,100-foot approach. There are 3 railway tracks on the approach and 2 freight tracks on each side of the wharf, with an additional track at the fruit-loading platform. Vessels of 32-foot draft and over can enter only the outer bay 3 miles off Barrios. There is 27 feet of water alongside the wharf at the outer berth and 22 feet at the inner berth. This port has scheduled connections with New York, New Orleans, Havana, Jamaica, Canal Zone, and Honduras and European ports.

At San Jose vessels lie off about half a mile from the pier, anchorage being an open roadstead. The pier is partly sheltered and is owned by the International Railways of Central America. Equipment consists of 4 hoists, 25 tons maximum, 11 lighters, and 2 tugs. Passengers are lightered. San Jose has scheduled connections with San Francisco and New York and unscheduled connections with Europe.

At Champerico, also, ships anchor in an open roadstead three-quarters of a mile off the pier. The pier is 1,000 feet long, partly sheltered, and equipped with four 5-ton and one 25-ton hoists. There are ten 50-ton lighters and 2 tugs. Passengers are lightered. Champerico has scheduled connections with New York and San Francisco.

Livingston is about 12 miles west of Barrios. Anchorage is 2 miles north of the official buildings. This is an entrepôt for the Coban coffee section.

Highways.—Guatemala has three groups of highways, namely, (1) those roads which serve the highland section of southern Guatemala, (2) the roads connecting Coban with Pancajche and El Rancho, and (3) isolated or service roads leading from the coffee-producing areas to the International Railway where it parallels the Pacific coastal range from the Mexican boundary to Escuintla. Under President Ubico a highway program has been maintained as vigorous as the finances of the Government would permit.

The main or national highway runs from the Salvadoran boundary to Quezaltenango. This will become part of the inter-American highway. There are roads leading from Quezaltenango to Coatepeque, Retalhuleu, Mezatenango, and Ayutla in the Pacific lowlands, and to San Marcos, Huehuetenango, and Quiche in the highlands. Other roads from the national highway to the Pacific coastal plains run from Godinez (between Solola and Patzum) to Patulul, from Antigua to Escuintla, and from Guatemala City to Escuintla. There is a dry-season road from Retalhuleu to Champerico and another from Escuintla to San Jose; also Quezaltenango to San Marcos; Quezaltenango to Quiche via Totonicapan; Jalapa to Jalapa Station on the International Railway; San Antonio Suchitepequez to Palo Gordo; Tumbador to Pajapeta; Solola to Patzum; and Flores Peten to La Libertad, Peten.

The entire western highland section is dependent on roads for communication. Regular freight lines are established between Quezaltenango and the chief towns of the Departments of San Marcos, Totonicapan, and Quiche. Antigua is served by motor truck from Guatemala City and Escuintla. Santa Rosa, Jutiapa, and a portion of Jalapa depend on highway traffic for their imports. Coban is entirely dependent on the Coban-Pancajche Road. The Coban-Pancajche Road was built and is maintained by coffee planters. The Coban-El Rancho Road via Salama can be traveled by motor in dry season. The only roads which can be used freely in all seasons are Guatemala-Antigua-Escuintla, Quezaltenango to Mazatenango, and San Marcos to Huehuetenango. According to the Bureau of Roads of the Ministry of Agriculture, the extent of highways in 1931 was as given in table 11.

The southern part of the Republic is entirely cut off from the northern part, and to rectify this situation President Ubico wants to construct a highway from the capital to Coban and on into El Peten. There has been some talk of colonizing Peten with foreign agriculturists, selling them land at reasonable prices, and devoting the proceeds to the building of this road.

Routes regularly served by automobiles carrying passengers, mail, and express are: Guatemala City to Tecpam via Antigua and Chimaltenango; and Quezaltenango to Huehuetenango.

TABLE 11.—*Status of the highways in 1931*

Kind	Miles	Kilometers
Unimproved	721	1, 160
Earth, partially improved	100	161
Earth with first improvements	385	619
Gravel	146	235
Macadam	15	25
Total	¹ 1, 367	2, 200

¹ By the end of 1931, mileage had increased to 1,477.

Railways.—As of December 31, 1931, there were 773 miles of railways in operation in Guatemala, of which

632 miles were common carrier lines. Main line trackage was as shown in table 12.

The main line of the International Railways runs from Puerto Barrios to Guatemala City, 198 miles; from Guatemala City to San Jose on the Pacific, 75 miles; and from Santa Maria to Ayutla, near the Mexican border, 123 miles. Branch lines run from Ayutla to Ocos, a Pacific port, 12 miles; Las Cruces to Champerico, 18 miles; Mulua to San Felipe, 10 miles, where connection is made with the Government electric standard-gage line to Quezaltenango, the second city of the Republic. From Zacapa, 104 miles from Barrios, the El Salvador branch runs to the Salvador frontier, 70 miles; thence 96 miles to San Salvador. From San Salvador a line extends to Cutuco (La Union) on the Pacific, 157 miles. Sixty-two miles from San Salvador, at Texistepeque Junction is a 36-mile branch line to Santa Ana, the second city of El Salvador. There is daily service between Barrios and the capital, and between San Jose and Ayutla and the capital. The International Railways of Central America is 3-foot gage.

The Los Altos Railway to Quezaltenango is German constructed. It is equipped with six passenger cars, each accommodating 42 passengers, and eight 15-ton freight cars.

The Verapaz Railway is 80 percent waterway as it has a monopoly of the water traffic from Livingston to Panzos, 110 miles, and operates a railway 28 miles long from Panzos to Pancajche.

TABLE 12.—Main line railroad trackage in 1931

Railroad:	Miles
International Railways of Central America.....	510
F. C. N. de los Altos.....	28
F. C. Verapaz.....	28
Guatemala Plantation Railways.....	88
Rio Bravo Line.....	20
Los Angeles Line.....	10
Total.....	684

Waterways.—The principal waterways used commercially are the Rio Polochic-Lake Izabal-Rio Dulce system, connecting with the Verapaz Railway from Panzos to Pancajche and the highway to Coban. This forms the only outlet for the department of Alta Verapaz and parts of Baja Verapaz and Izabal. The Rio Usamacinta and its tributaries are used for floating out mahogany logs. The Rio Belize is the main route for the northern part of El Peten. There is a small canal paralleling the Pacific coast and about 100 yards inland, that runs to Istapa and is used by small freight bateaux. Lakes Atitlan and Amatitlan give transportation service to numerous towns on their borders.

Airways.—The topography of Guatemala is such that in some instances it is cheaper to travel by air. As an outstanding example, it requires 12 to 14 days

to go from the capital to Flores Peten overland, while an airplane requires but 2 hours. Airplane fields are located at La Aurora, a few minutes from the capital, used by the Pan American Airways and the Compania Nacional de Aviacion; Flores and La Libertad, in Peten; Coban and Tactic in Alta Verapaz; Salama and Rabinal in Baja Verapaz; Puerto Barrios and Playitas, in Izabal; Chiquimula and Esquipulas in Chiquimula; Zacapa and Teculután in Zacapa; San Jose and Tiquisate in Escuintla; Quezaltenango and Coatepeque in Quezaltenango; also at Jutiapa, Jalapa, Mazatenango, Retalhuleu, Huehuetenango, and San Marcos.

Pan American Airways maintains a scheduled service to the capital, and the Compania Nacional de Aviacion flies regularly to a number of the larger towns, Quezaltenango, Coatepeque, Retalhuleu, Mazatenango, Tiquisate, Jalapa, Salama, Tactic, Coban, and Rabinal. There is a weekly service to Peten.

Automobile statistics.—The Automotive-Aeronautics Trade Division of the Bureau of Foreign and Domestic Commerce, United States Department of Commerce, in its motor-vehicle census for January 1, 1933, gives the following for Guatemala:

Passenger cars.....	2, 537
Busses.....	263
Trucks.....	847
Total.....	3, 647

HIGHWAY ECONOMICS

Existing bus service.—According to the American vice consul at Guatemala, there are no interurban busses operating on regular schedules in the interior of the country. There is a bus line from Coban to Pancajche. Between Guatemala City and such points as Tecpan, Chimaltenango, Antigua, and Escuintla, a few privately owned trucks carry passengers. They have no schedules. There are a number of old converted touring cars carrying some 20 passengers each which operate between definite suburban points and the center of Guatemala City. Five organized concerns operate street busses in the capital and environs on regular runs. These concerns have an aggregate of 114 busses. They carry an estimated 6,800,000 passengers annually. There are no government or municipal regulations governing bus service.

Future highway development.—The following are suggested as practicable locations for future road construction, connecting with the proposed inter-American highway, and over which bus and truck operations could eventually be developed:

1. Asuncion Mita connecting with Chiquimula, Zacapa, and to points between this and Puerto Barrios. This line touches the railway at Zacapa.
2. At Cuajiniquilapa, short roads radiating into the Department of Santa Rosa.

3. Roads could lead both north and south from the following points:

- (a) Chimaltenango
- (b) Tecpam
- (c) Totonicapan
- (d) Quezaltenango
- (e) San Marcos
- (f) Malacatan

Such roads from (a) would serve the Departments of Chimaltenango and Baja Verapaz to the north and Chimaltenango and Sacatepeque to the south.

From (b) they would serve the Departments of Chimaltenango and El Quiche to the north and Chimaltenango and Solola to the south. There is now a fair road from Patzicia to Solola and Lake Atitlan.

From (c) the Departments of Totonicapan and Huehuetenango could be served to the north and Totonicapan, Solola, and Suchitepequez to the south.

From (d) the Departments of Totonicapan and Huehuetenango to the north and Retalhuleu to the south would be served.

From (e) service would be given to the Departments of San Marcos to the north and Quezaltenango to the south.

From (f) the Departments of San Marcos to the north and Quezaltenango to the south would be served.

Tourist traffic.—According to figures of the Guatemalan Government about 6,000 tourists visited the Republic in 1932. But the Government places commercial travelers and clericals in the tourist category. The Grace Line boats (Panama Mail) brought about 2,000 tourists to Guatemala during 1932, which was a good year despite the depression. Adding four large vessels to their Pacific coast service during the current year (1933) they estimated the total for the year would be about 4,000. The Grace Line now has 8 ships calling at Guatemala, the 4 small ones anchoring off Champerico and the large ones off San Jose. A guide accompanies the tourists. This company has made provision for two classes of tourists: Those who desire but 1 day in the country, and those desiring a 2 weeks' stop-over en route from San Francisco to New York, or return. A special water-rail rate has been adopted—water to New York and transcontinental rail to San Francisco, or the reverse. Special rates are given for parties of not less than 6 nor more than 20 tourists. For \$20 the company takes a tourist from San Jose by rail to the capital, providing two meals at the Palace Hotel, a bus ride around the city, and the return to ship on the evening of the same day.

Another trip is by rail to Escuintla, thence by motor over the highway to the historic city of Antigua, steeped in romanticism, thence by highway to the capital, and thence by rail to San Jose.

A trip now being planned for tourists arriving at Champerico is from that point by motor or bus to Quezaltenango, around Lake Atitlan, considered by

many to be the most beautiful mountain lake in the world, and on to Antigua and the capital; thence to a port in El Salvador where the tourists will find their vessel waiting. This trip, and a San Jose-El Salvador trip, would be immensely popular once the inter-American highway materializes. It is replete with magnificent scenery and glimpses of Indian life changed but little from Mayan times.

In 1932 President Ubico named an official tourist committee, of which the Assistant Secretary of Foreign Relations (Señor Eduardo Giron) is chairman, to stimulate "tourismo." Mr. Alfred S. Clark, a progressive American business man in Guatemala, plans a chain of tourist inns. The first one, The Mayan Inn, was opened this year at Chichicastenango, to which Mr. Clark takes tourists over the Tecpam highline, returning by way of Solola and along Lake Atitlan. He gives the stop-over tourists motor trips radiating out of Chichicastenango to the most interesting Indian towns of the country.

The United Fruit Co. vessels ("The Great White Fleet") are paying more attention than formerly to tourist business. The company has made a reduction in rates from New York or New Orleans to Puerto Barrios. For \$50 extra the tourist may spend a week at the capital. The charge includes round trip by rail, luncheon at Zacapa, and hotel accommodations. This company has made arrangements with Compagnie Transatlantique (French Line) by which passengers may disembark at La Libertad, El Salvador, go by rail to San Salvador and Zacapa, and out through Barrios. The Dollar Line also is planning scheduled calls at San Jose and interior tourist trips.

Improved highway connections will greatly increase tourist trade. The United States commercial attaché, stationed in Guatemala before that office was abolished, reports that "the completion of the inter-American highway would make Guatemala one of the most popular tourist resorts in the Western Hemisphere." As a field for the hunter and fisherman, Guatemala ranks high. Deer, wild pig, tapir, various members of the cat family, and game birds of many species are abundant.

Government bureau of highways.—Highways are controlled by the director general of roads, under the Ministry of Agriculture, except for roads in the capital, which come under the municipal engineer.

In 1931 the Government expended \$93,056 on road repair work, to which should be added 283,113 tasks performed by volunteer labor during "road work week", 28,467 tasks by labor lent by farmers, and 4,047 tasks by labor furnished by municipalities, worth over \$100,000 at current labor rates of 20 pesos (33½ cents) a day. Estimated 1932 road costs, according to the budget, were \$250,000.

The annual budget figures give the following:

Year	Administra- tive expense	Road expendi- tures	Total
1929-30.....	\$105,480	\$700,000	\$805,480
1930-31.....	107,460	700,000	807,460
1931-32.....	70,260	250,000	320,260

Funds are obtained from general revenues, poll tax for roads, and special taxes. In May 1930 a tax of 5 cents a gallon on gasoline was established to be used on highway repairs. In August 1931 a further levy of 4 cents was made on gas for paying off indebtedness to an American company for paving done that year. Gasoline consumption now runs approximately 2,000,000 gallons annually. A tax of \$1 is collected per square meter from property fronting on paved streets. The San Jose-Escuintla road charges a toll of 75 cents for trucks and 50 cents for automobiles at Masagua. This road is also aided by merchant and private subscriptions. Presidential Decree 1474, October 31, 1933, obliges all able-bodied individuals to give 2 weeks of personal service annually, or the equivalent in money, commutation at the rate of \$1 a week, to the public highways to which they may be assigned.

PUBLIC LANDS

Nationally owned lands in Guatemala represent more than a quarter of the entire area of the country, according to information obtained from the Minister of Agriculture in November 1933. The total extent of nationally owned lands was placed at 35,356 square kilometers, most of it located in the less accessible regions of the country. The only department traversed by the proposed route of the inter-American highway which has some public lands is San Marcos, although larger areas are also found in the Departments of Baja Verapaz, Quiche, Chiquimula, and Huehuetenango, which are contiguous to departments on the route.

FOREIGN TRADE

From the Commerce Yearbook of 1932 the figures shown in table 13 are taken, showing Guatemala's foreign trade for the past 7 years.

This gives a total for the 7-year period for imports of \$144,029,000, exports \$165,429,000, and a favorable balance of trade on the face of the figures of about \$21,000,000, or at the rate of \$3,000,000 annually. Inasmuch as Guatemala adds 25 percent to the value of imports, an amount estimated to cover the charges for freight, insurance, etc., this favorable trade balance is in reality somewhat greater. Roughly, per capita imports have averaged just about \$10 annually.

TABLE 13.—*Foreign trade, 1926-32*

Year	Imports	Exports
1926.....	\$26,602,000	\$28,968,000
1927.....	22,685,000	33,915,000
1928.....	27,431,000	28,212,000
1929.....	130,399,000	24,928,000
1930.....	116,474,000	23,578,000
1931.....	112,971,000	15,167,000
1932.....	17,467,000	10,651,000

¹ Including value of parcel-post trade not shown separately.

FINANCE

Government receipts and expenditures.—Actual receipts of the Guatemala Government for the fiscal year 1931-32 totaled 9,220,081 quetzales (par value of the quetzal being equal to \$1 United States currency) not including 200,170 quetzales which represented Banco Central payments for fiduciary circulation carried as cash receipts. Expenditures for 1931-32 totaled 9,876,033 quetzales. The distribution was as given in table 14.

Expenditures for 1931-32 were 25 percent below those of 1930-31, and 31½ percent below those of 1929-30. Receipts fell off nearly 14 percent, compared with 1930-31 and 31 percent below 1929-30.

The tentative budget, receipts and expenditures, for 1933-34 was balanced at \$8,582,024 each. Under the regime of President Ubico drastic economy has been the watchword of the hour and malfeasance in the handling of public funds has become a very dangerous practice. As of December 31, 1932, the value of real estate registered with the National Government was \$129,521,000. The land tax that year yielded \$279,674, an increase of nearly \$54,000 over the year before.

TABLE 14.—*Government receipts and expenditures, 1931-32*

Receipts		Expenditures	
Source	Amount	Purpose of expenditure	Amount
Import duties.....	\$3,688,982	Legislative.....	133,283
Export duties.....	1,463,261	Executive.....	211,301
Liquors and monopolies.....	1,923,305	Judicial.....	256,336
Consular fees.....	195,022	Government and justice.....	1,346,383
Special treasures.....	259,614	Foreign relations.....	386,882
Banking sources.....	151,100	War.....	1,511,010
Postal and wires.....	435,284	Education.....	1,013,299
Miscellaneous.....	1,103,513	Development.....	1,149,440
		Agriculture.....	475,523
		Finance.....	888,060
		Public debt.....	2,504,516
Total.....	9,220,081	Total.....	9,876,033

Public debt.—According to the report of the Minister of Finance and Public Credit to the National Assembly of Guatemala, March 1, 1933, the public debt was comprised of the following items as of December 31, 1932:

Los Altos Railway bonds.....	\$1,749,000.00
Bonds of the Republic, 1927.....	2,214,000.00
Internal debt bonds.....	190,774.29
Northern Railway bonds.....	92,652.97
External debt bonds, 7 percent.....	2,460,484.01
Floating debt.....	156,470.90
Automatic telephones, A.E.G.....	440,134.09
Savings Bank & Trust Co., Washington.....	45,000.00
Central Bank, contract of Aug. 23, 1927.....	54,000.00
Anglo-South American Bank, contract of 1931.....	2,393,784.16
Various creditors.....	7,876.99
Nonpaid refunds, account of pensions.....	3,325.49
Other liabilities.....	106,697.97
Administrative debts for 1932-33.....	1,545,734.90
Deficits on previous budgets.....	2,588,652.59
Total dollar obligations.....	14,048,588.36
British sterling debt, 4 percent.....	£1,490,620.00

Depressed conditions and dwindling revenues compelled Guatemala to cease amortization payments on its public debt December 31, 1932, but at great sacrifice to its internal development under an administration which but for lack of normal income would have registered satisfactory progress, it has kept up interest payments.

American investments.—American investments in Guatemala, according to information contained in Trade Information Bulletins Nos. 731 and 767, totaled \$75,107,000 at the end of 1930, of which \$70,729,000 was in the form of direct investments, and \$4,378,000 was invested in Guatemalan bonds and other securities. Of the (approximately) \$70,000,000 invested in Guatemalan enterprises, \$55,000,000 is invested in public utilities and communications, and the remainder (\$15,000,000) in miscellaneous enterprises.

Railways, electric lighting and power systems, radio and cable stations, fruit and coffee plantations, chicle lands, oil, gold dredging, banking, and industrial and commercial projects form the bulk of American direct investments in Guatemala. Among the more important American firms having investments in Guatemala are:

The International Railways of Central America, which owns and operates railways in Guatemala, and in addition, through various subsidiaries, is interested in mining, quarrying, and cement manufacturing.

American & Foreign Power Co., which controls the electric lighting system of Guatemala City.

United Fruit Co., which owns and has under lease large tracts of land, a good part of which is under banana cultivation; and also operates a radio station in Guatemala.

American Chicle Co., which controls large areas of chicle-producing lands.

Other American companies with investments in Guatemala are the All-American Cables, Inc., New York Engineering Co., etc.

Other foreign investments in Guatemala, as of December 31, 1930, include:

British:

Investments in Government bonds.....	\$8, 000, 000
Anglo-South American Bank, advances to Government and local financing.....	2, 500, 000
Trading, haciendas, etc. (estimated).....	8, 000, 000
Total British investments (estimated).....	18, 500, 000

German:

Coffee plantations, public utilities, banks, and mercantile establishments (estimated).....	20, 000, 000
Due by Government to A.E.G. Jan. 31, 1931.....	500, 000
Total German investments (estimated).....	20, 500, 000
Other foreign investments (estimated).....	3, 000, 000

TECHNICAL SECTION

The proposed route.—The southeastern terminus of the recommended route of the inter-American highway in Guatemala is the crossing of a small stream by the present road from Santa Ana, El Salvador, to Asuncion Mita, Guatemala, near San Cristobal. This stream marks the boundary between El Salvador and Guatemala. The northwestern terminus is a crossing of the Rio Suchiate west of Malacatan, Guatemala. The Rio Suchiate is bridged at this point and defines the boundary between the republics of Mexico and Guatemala.

Connections are made at Jutiapa, Guatemala City, Chimaltenango, Quezaltenango, and San Marcos with the national system of airways; at Guatemala City with the Pan American Airways and the system of national railways (International Railways of Central America); and at Quezaltenango with an electric line running to Retalhuleu, in the Pacific lowlands. Junctions are made at Asuncion Mita with earth roads leading to Chiquimula and Metapan; at Molino with one to Ahuachapan, El Salvador; at Guatemala City with earth roads radiating into the surrounding country; and at Chimaltenango, Totonicapan, Quezaltenango, San Juan, Ostuncalco, and San Marcos, with earth roads and trails into the adjoining country.

In determining a route for the inter-American highway through Guatemala, a decision had to be made as to whether the line should follow in general the Continental Divide, or whether it should follow the foothills and coastal plain along the Pacific. Consideration of a line along the Atlantic side was eliminated from further study by the general decision to follow the Pacific watershed where possible.

Consideration of a line along the Pacific slopes and lowlands was also abandoned, because this section of the country is at present well served by a railroad, there would be many expensive drainage structures over rather large streams, a large part of the construction would be entirely new, and the route would not pass through the principal centers of population of the country.

With the elimination of the Atlantic and Pacific lines from consideration, efforts were concentrated on the high line.

This line follows the elevated plateau which forms the intensely cultivated interior section of Guatemala, where approximately 50 percent of the inhabitants of the country live. Transportation throughout the entire region is dependent on highways, and their development will greatly facilitate the movement of industrial and agricultural commodities. Such a route would connect the capital city with the important towns of the interior, and, as the divide between the Atlantic and Pacific coastal drainage is followed for a great part

of the distance, numerous major drainage structures necessary on a line near the coast would be eliminated.

An existing road through the Republic from the El Salvador line to San Rafael has been used for many years, and recently that part from San Rafael to the Mexican border has been opened to automobile traffic in dry weather.

It was not advisable, however, to follow this route without investigating several possible alternates for various sections, and more particularly to study other possible connections at the Mexican line.

The longer alternates studied are as follows:

1. From the El Salvador border (Rio La Paz) near the village of Platauar in the Department of Jutiapa, via Jalpatagua, to a point on the selected route east of Oratorio in the Department of Santa Rosa, a distance of approximately 60 kilometers.

2. Leaving the selected route near Guatemala City, passing through Antigua to again join the selected route at Chimaltenango, a distance of 37.8 kilometers.

The historical interest attached to the ancient capital of Guatemala, Antigua, and the possibility of the attractions which its ruins might have for tourists, made it worth while considering the indirect route through this point from Guatemala City to Chimaltenango.

3. Leaving the selected route at Patzicia, passing by Lake Atitlan, through Solola to a junction with the selected route at Los Encuentros, a distance of 71.2 kilometers.

4. Leaving the selected route at San Mateo, near San Juan Ostuncalco, passing through Coatepeque to Ayutla on the Mexican frontier, a distance of approximately 85 kilometers.

5. Leaving the selected route at Quezaltenango, passing through Huehuetenango and Nenton, to the Mexican border near Comitán, a distance of approximately 200 kilometers.

6. Leaving the selected route at Quezaltenango, passing through Huehuetenango, to the Mexican border near Motocintla, a distance of approximately 170 kilometers.

All of these alternates were rejected and the principal reasons for such action are as follows:

Alternate route 1: (a) There is no improved road connection in El Salvador, and the necessary connection is not the one preferred by that country.

(b) The towns are smaller and fewer and the area is less thickly populated than along the selected route.

(c) The existing highway along the selected route is in much better condition than along the alternate.

(d) A comparison of the two profiles shows the selected route traversing less broken and irregular terrain.

(e) A new bridge and its approaches required at the Rio La Paz will be expensive to construct, and a new road from the Rio La Paz to Jacatillo will involve some exceedingly heavy work and several minor bridges.

(f) It was the desire of the Government officials of Guatemala that the route passing through Asuncion Mita and Jutiapa, the capital of the Department of Jutiapa, be improved and form a section of the proposed inter-American highway. Asuncion Mita has a population of 2,552 and Jutiapa of 2,652. The largest town on alternate route 1, Jalpatagua, has a population of 545.

Alternate route 2: (a) The route via Antigua is longer than the direct route from Guatemala City to Chimaltenango.

(b) Between Guatemala and Chimaltenango, on the alternate location through Antigua, the existing earth road has a width considerably less than that on the direct route, and the cost of widening this section and of reducing curvature and gradients will be more costly than on the direct route.

(c) Between Antigua and Chimaltenango, for a distance of several kilometers, dwellings line both sides of the highway and would prohibit the future widening and development which would be necessary adequately to accommodate motor vehicular traffic.

(d) Tourists interested in Antigua can use the alternate route, and traffic would thus be divided with less probability of the route through Antigua being burdened beyond capacity.

Alternate route 3: (a) The route is longer than the selected route.

(b) The cost of widening the roadway and of reducing curvature and gradients will be more costly than on the selected route.

(c) Drainage structures will exceed in size and cost those on the selected route.

Alternate route 4: (a) There are more and larger streams to be bridged than on the selected route.

(b) It is longer than the selected route.

(c) It parallels the railroad from Coatepeque to the Mexican line, therefore serving a section that already has transportation facilities.

Alternate route 5: In the event the Republics of Guatemala and Mexico do not agree to meet at the point which it is understood the two Governments have informally accepted on the Rio Suchiate, near Malacatan, Guatemala, and Tapachula, Mexico, the route via Nenton and Comitán may receive further consideration.

It leaves the selected route at Quezaltenango and is a fair road, traversable for automobiles in dry weather for 83 kilometers, to a point 11 kilometers from Huehuetenango, in the Department of the same name.

From this point to Nenton the route follows in general the old Camino de Herradura built in the days of the Spanish occupation. Such roads are the principal means of communication throughout this territory. It passes through or near the towns of Chiantla, Chemal, Paza, San Marcos (Department of Huehue-

tenango), San Andres, Nenton, Siete Pinos, Tunal, and thence across the frontier to Sachana and Comitán, Mexico.

It is understood that Guatemala considers the construction of this highway as of primary importance to the future development of the country. It would traverse territories rich in natural resources possible of development.

At some future date the Government hopes to open this route, but it was dropped from further consideration when investigation disclosed that its cost would be prohibitive at present and place a much heavier financial burden upon the country than does the selected route.

Alternate route 6: From Quezaltenango to Motocintla, Mexico, via Huehuetenango, this route presents a second possible connection which it is understood the Mexican Government road officials offered for consideration to the Government of Guatemala.

It appears from the conference held by the representatives of the two Governments that the Mexicans do not favor road construction in the southwestern coastal section of Mexico in the Department of Chiapas. Rather they prefer building in a southeasterly direction from Tuxtla Gutierrez to Comitán, and, if necessary, to continue the construction to Motocintla in order to effect a junction with the Guatemala highway system. If a junction point is chosen at the border between Guatemala and Mexico near Motocintla, Mexico, alternate route 6 will be identical with alternate route 5 as far as Huehuetenango. From Huehuetenango to the crossing of the Rio Naranjo the road has been graded. The Rio Naranjo crossing is approximately 8 kilometers in a westerly direction from Huehuetenango, and Motocintla, Mexico, lies almost directly west from Huehuetenango. From Huehuetenango the proposed highway would probably ascend the valley of the Rio Naranjo and cross the divide between the Rio Naranjo and the Rio Cuilco near the town of Santa Barbara, go thence down the valley of the Rio Cuilco, following generally the route of the old Spanish roads through the towns of San Ildefonso Ixtahua, Casaca, Queva, Cuilco, Jocotitlán, and across the boundary to Mazapa and Motocintla, Mexico; or, from Cuilco through Chiquihuil and Platanillo to the border of Mexico.

Considering the selected route with a junction near Tapachula, Mexico, as first choice for the Guatemalan Government, this alternate route would be considered second choice, although construction would not be attempted at this time because of the excessive cost of the required new work. The airline distance from Huehuetenango to Motocintla, Mexico, is 85 kilometers, of which only 8 kilometers are graded.

If the Mexican Government definitely decides not to build farther south than Motocintla, Mexico, it would become necessary for the Government of Guate-

mala to consider this alternate in order to provide for a junction with the Mexican highway system.

In contrast with the above considerations, the selection of the proposed route is directly supported by several important relations.

The section of the selected route matching alternate route 1 begins near San Cristobal, where it connects with a paved road of excellent grade and alignment in El Salvador.

The territory traversed from San Cristobal to the junction with alternate route 1 near Oratorio is highly cultivated, well populated, and comprises the important towns of Asuncion Mita and Jutiapa.

This section of road is in fairly good condition and there is a daily passenger automobile service passing over it. It is understood that this service is maintained throughout the rainy season.

Northwest of Guatemala City, alternate routes 2 and 3 were considered only because of historical, antiquarian, or scenic attractions associated with the ancient city of Antigua, and the beautiful Lake Atitlán, a place which is being considered as a vacation resort for Guatemalans. These reasons do not seem to justify the excessive construction costs that would be entailed.

Alternate route 4 was given consideration as a possible approach to Ayutla, and if it were not for the existence of a railroad between Coatepeque and Ayutla and the fact that the selected route serves a well-developed and populated territory, it might have been chosen for the inter-American highway.

Alternate routes 5 and 6 were investigated only because the Mexican Government has not yet surveyed beyond Comitán, and consequently, either of these alternates in Guatemala may be involved at the international boundary. Inasmuch as either route will entail a heavy additional expenditure for Guatemala and delay indefinitely the construction of the highway through this country, it was thought advisable to discard them. Possibly some future day will see a connection through here, especially as Guatemala is anxious to open the territory traversed by the routes. There is no doubt but that an extension of the Quezaltenango-Huehuetenango road to the Mexican frontier would open a vast, undeveloped territory in Guatemala, and the present officials seem anxious for this to be done at some future date. Accordingly, the survey was carried to the Rio Suchiate near Tapachula, Mexico.

Control points.—The route through Guatemala has been chosen largely with the view to serving the centers of population and opening up territory not reached by the railroads, while at all times bearing in mind its feasibility. The fact that there is at present a road approximating the selected route, evinces the usefulness to the Republic of a highway through this territory.

Therefore, in designating the control points, particular attention was given to the centers of population, but only after being satisfied that a highway of the required standards could be built between them, and with a view to controlling the line without confining the locating engineer's activities.

In view of the above, the control points shown in table 15 are selected.

Running description.—Beginning at the El Salvador frontier near San Cristobal, elevation 2,140 feet (656 meters) the route traverses rolling country and passes along the shore of the beautiful Lake Atescatempa dotted with small sailboats used by fishermen in quest of their daily food, before crossing the Rio Mongoy at kilometer 1,957.3. This stream and the Rio Tamasulapa are crossed before reaching Asuncion Mita. They are beautiful rivers lying in productive valleys. Their waters empty into Lake Guija, which is partly in Guatemala and partly in El Salvador. There are many evidences through here, in the form of mounds and graves, of an ancient civilization.

TABLE 15.—Control points on proposed route of highway

Name	Elevation	
	Feet	Meters
San Cristobal.....	2,140	656
Asuncion Mita.....	1,653	504
Jutiapa.....	3,024	922
Rio Esclavos Bridge.....	2,499	762
Guatemala City.....	4,904	1,495
Chimaltenango.....	5,865	1,788
Tecpan.....	7,462	2,275
Encuentros.....	8,331	2,540
Totonicapan.....	8,167	2,490
Quezaltenango.....	7,642	2,330
San Marcos.....	7,688	2,344
Malacatan.....	1,404	428
Rio Suchiate crossing.....	1,148	350

The present road as far as the Rio Mongoy is rough and rocky and has much unnecessary curvature as well as short excessive grades in several places. A very satisfactory line can be had by slightly deviating from the existing road particularly at kilometers 1,952 and 1,956.

From the Rio Mongoy to Asuncion Mita, kilometer 1,969, a town of importance lying in a large valley and at the intersection of important roads, the present road follows generally along water grades, passes through two gaps at kilometers 1,961 and 1,962. A good location can be had through this section by varying slightly from the present road.

The Rio Tamasulapa at kilometer 1,965.4 is at present forded at a poor location for a bridge, which should be placed at a much better site a short distance upstream.

Leaving Asuncion Mita, there is an ascent of about 1,200 feet (370 meters) up the drainage basin and across the tributaries of the Rio Tamasulapa before reaching the small plateau on which Jutiapa is located at kilometer 1,999.7.

Beautiful valleys, ridges, and distant peaks are visible all along the line.

Jutiapa, the capital of the Department of that name, is in the center of a very productive and important section and lies near the headwaters of the Rio Tamasulapa.

The present road has been surfaced, but is in poor condition between Asuncion Mita and kilometer 1,971.3. Here it becomes narrow and begins the ascent to the gap at kilometer 1,973.7. The curvature between these points is not bad but there are short sections of excessive grade. A relocation up the left of the ravine may prove advantageous; however, it is believed that the objectionable features can be more economically remedied by minor revisions in the present road. There is abundant surfacing material available.

After passing through the gap at kilometer 1,974.4, the line continues to rise over a narrow road with an undulating grade and fair alinement to the subsummit at kilometer 1,979.5. Between these points there are several subsummits, the more prominent being at kilometers 1,976.8 and 1,978.1. Between kilometers 1,976.8 and 1,979.5 there is a section of road surfaced with volcanic material that is in good condition. After leaving kilometer 1,979.5 the road continues to rise, but at intervals crosses small streams until it reaches kilometer 1,986.3. There are several kilometers of excellent location through here and that which is not up to standard could be made so with very little expenditure. Surfacing materials are plentiful.

At kilometer 1,986.3 the road reaches the plateau on which Jutiapa is located, and from here to Jutiapa there exists a fair earth road with no bad curvature or grades except at points where some of the streams like the Quebrada Tajada at kilometer 1,998.1 and the Rio de la Virgen at kilometer 1,999 are crossed, and at these points the objectionable features can easily be remedied by very slight revisions in grades. There is excellent material all along the route.

Soon after leaving Jutiapa the ridge between the waters of the Rio Tamasulapa and those of the Rio La Paz is crossed. The latter river flows into the Pacific Ocean and forms a part of the boundary line between Guatemala and El Salvador.

The route traverses the upper drainage basin of the Rio La Paz to kilometer 2,028, at which point the divide between the waters of the Rio La Paz and those of the Rio Esclavos is crossed at an elevation of 4,520 feet (1,375 meters). From this divide the route approaches the valley of the Rio Esclavos by way of its tributary the Rio Las Lajas, and continues in this valley to the control point at the Rio Esclavos bridge at kilometer 2,053.

The present road between the control points of Jutiapa and the Rio Esclavos bridge is of earth,

although some gravel surfacing has been attempted between kilometers 2,044 and 2,047.

From Jutiapa to kilometer 2,006.7, a crossing of a branch of the Rio La Paz, the road is well-located, with rolling grades and a fair surface of natural soil, and from this point to La Pava, kilometer 2,010.5, an excellent location may be had by slightly deviating from the present line. A short section of relocation following the ridge to the left of the present road seems advisable at kilometer 2,010. Material is available in large quantities, both stone and lava.

From La Pava, kilometer 2,010.5 to kilometer 2,015.7 there are sections near the crossings of streams where slight variations in grade or alinement from the present road will be necessary. The most important of these is between kilometers 2,014 and 2,015.7 where the grade should be made uniform.

From kilometer 2,015.7 to Ceibita, kilometer 2,021.5, the present road is well located and has a fairly good surface on a wide grade. Material through here is scarce, but the natural soil appears to hold up well under present traffic.

Leaving Ceibita, the ascent to the summit, kilometer 2,028, is over a narrow road with much curvature, especially between kilometers 2,022.4 and 2,026.6 where it would seem advisable to hold to the ridge to the right. Rolling grades and fair alinement are found from this point to the divide between the Rios La Paz and Esclavos at kilometer 2,035.3. Just before reaching this divide much improvement could be had by a slightly altered alinement. Material is easily accessible throughout this section.

Azucualpillo, located almost at the divide, kilometer 2,035.3, is the starting point for the descent into the Rio Esclavos Valley. Approach to the valley is made over a narrow, winding road with a fair surface. The average grade is not excessive, although there are places above 10 percent where evidently the original survey was not followed. The descent to the Rio Esclavos is along the Lajas, one of its tributaries, and the confluence of these streams is at kilometer 2,047.4.

This descent for a distance of about 12 kilometers has an average grade of approximately 6.4 percent. It would be difficult and costly to alter materially the location with the idea of reducing grades and curvature. However, it is suggested that on such long supported grades on broken mountain sides, the old road be adhered to as nearly as possible, and that curves of minimum radii be confined to the points where ample sight distances are procurable. Much improvement will result from making the grades uniform.

After reaching the Esclavos, its left bank is followed downstream on a road of fair surface and with good alinement and grades. Some places along this section are subject to overflow from the river and at these points the line should be thrown nearer the foothills.

Throughout the section contiguous to the Rio Esclavos there is abundant surfacing material and a sand pit has been opened at Rio Molino, kilometer 2,045.

At kilometer 2,053 there is an old arch bridge over the Rio Esclavos built in 1592 by the Spaniards. The structure is massive, in a good state of preservation, has 10 arches of brick and stone, is approximately 200 feet long and has a 12-foot roadway. At each end there is a dip in the approach that serves as an overflow during high water.

Leaving the control point of the Rio Esclavos bridge, the route to the control point of Guatemala City, kilometer 2,122, traverses the Rio Esclavos drainage to kilometer 2,065, from which point it is partly in the drainage basin of the Rio Maria Linda and partly on the divide between the waters of the Rio Maria Linda, flowing to the Pacific Ocean, and those of the Rio Grande, flowing to the Atlantic. It reaches an elevation of 1,900 meters at kilometer 2,104, the highest point between El Salvador border and Guatemala City. Throughout this section are many hectares of both heavily timbered and cultivated land, and the vistas along streams and panoramic views from mountain tops are seldom equaled.

The present road from the Rio Esclavos bridge to Guatemala City is probably on a very old location, as is shown by the great amount of erosion that has taken place. This is largely responsible for the unsatisfactory conditions of grade and alinement that occur in short stretches, and which are discussed more in detail hereinafter.

From the Rio Esclavos bridge to kilometer 2,056 there are several sections of short steep grades which can easily be eliminated by development either to the right or left. Other sections of short excessive grades occur, leaving the Rio Quilapa between kilometers 2,058 and 2,068. If found necessary these grades could be materially reduced by developing in the ravine to the right and on the ridge to the left. From kilometer 2,060 to 2,083 there are no grades that cannot be readily adjusted to conform to standards, except possibly at kilometer 2,070, where it may be advisable to go around the hill to the left. From kilometer 2,083 to Guatemala City there are no grades that cannot be brought to standard 7 percent by minor revisions in alinement.

Excessive curvature occurs throughout the line from the Rio Esclavos bridge to Guatemala City; and at two points it is very necessary to revise—at kilometer 2,063 to 2,065 and kilometer 2,083 to 2,085. The first should present no difficulty and the second can be improved by developing on the ridge to the left.

In general, the road from Los Verdes, kilometer 2,083, to Guatemala City is fairly well located. For a large part of the distance the road is in a cut due to erosion. This circumstance makes it somewhat difficult econom-

ically to secure good sight distance where there is much curvature.

The surface throughout from the Rio Esclavos bridge to Guatemala City has been improved from time to time with materials of various qualities, and for most of the distance the roadbed is of ample width for two-way traffic.

The surfacing from the bridge to about kilometer 2,092 is of any available local material, such as natural soil, volcanic ash, and some broken stone. From this point to Guatemala City there is for most of the distance an old badly worn macadam road, sections of which resemble a rough telford, and in some places natural material from the banks along the road has been used as a covering for this. The surfacing becomes wider near Guatemala City, where it has a width of 30 feet.

The section of road from the Rio Esclavos bridge to Guatemala City should be carefully studied before construction begins in order that as much as possible of the present grade and surfacing can be utilized in a design that embodies proper standards of grade and curvature. The above might apply equally as well to any section of road; however, it is felt that in this particular case the judicious movement of small amounts of material would result in a satisfactory road at small cost, where on the other hand, a relocation would require less tedious engineering but would result in the movement of large amounts of material at great expense without commensurate results.

The entire route from Guatemala City to the Mexican border is a mountainous section more rugged than that to the southeast.

Elevations exceeding 10,000 feet (3,100 meters) are reached along the line between Tecpam and Totonicapan. Throughout this section the scenery is magnificent.

From Guatemala City to Chimaltenango, kilometer 2,169, the route is in the Rio Maria Linda drainage basin to kilometer 2,142.5, and from this point is in the drainage basin of the Rio Guacalate.

The present road from kilometer 2,121 to 2,125.5 is surfaced with asphaltic material and from 2,132.5 to 2,143 with water-bound macadam. The surfacing is amply wide for two-way traffic to kilometer 2,142 where the section changes to a narrower width. There are no grades or curves of any consequence as far as Rio Molino, kilometer 2,133, but at this point there are excessive grades and bad curves which, however, can be brought to standard by slight revision of alinement and a higher bridge over the Rio Molino.

After leaving the town of Mixco, there is an ascent to a summit at kilometer 2,142.5, along which the road has excessive grades and sharp curves. These can be much improved by making the grades uniform and widening the curves. As the road here is along a steep mountain side, with slopes in excess of 30°, it would be

a costly procedure to abandon what has already been done for a new location. There is a quarry of good material at kilometer 2,137.

From the summit at kilometer 2,142.5 the road gradually descends over rolling terrain to Chimaltenango. There are sharp curves and short sections of excessive grade between the summit and kilometer 2,161, but these could be satisfactorily adjusted by slight changes in alinement. From kilometer 2,161 to Chimaltenango the alinement and grades are good.

The surface of the road from the summit to Chimaltenango is smooth in dry season, but undoubtedly becomes impassable after much rain. Very little surfacing material was observed through here. There is some stone at kilometer 2,160 and at kilometer 2,160.5 was noted a material on the surface of the road that it is said will stand through the rainy season. It is known as "talpetate", and when mixed 2 parts talpetate, 2 parts sand, and 1 part clay, gives an excellent all-weather surfacing.

The control points of Chimaltenango and Tecpam, kilometer 2,206, lie respectively in the drainage basins of the Rio Guacalate and Coyalate. The route between these control points follows up the Guacalate to the Divide at kilometer 2,174 and thence down the Coyalate. The present road between the control points is on good alinement and grades, with the exception of those sections near kilometer 2,183 at the crossing of the Rio Pachoc and near kilometer 2,200. These sections can very economically be brought up to standard by bridging the Rio Pachoc and realining the section contiguous to kilometer 2,200.

That section from Chimaltenango to Chirijuyu has no excessive curvature or grades but could be shortened somewhat by a changed location, but on account of cost this is not recommended.

After leaving Chimaltenango, and as far as kilometer 2,200, the road is of ample width for two-way traffic, and the surface is good though very dusty in dry weather. For the remainder of the distance to Tecpam the width is sufficient for vehicles to pass but would not be safe for a much heavier two-way traffic than now exists. The surface is smooth in dry season but very dusty. There is material for surfacing available but it is confined to that section between the Divide and Tecpam. In the level section adjacent to Chimaltenango there is none other than sand and clay, and this would not hold up under wet-season rains in this level section without a great amount of maintenance.

From Tecpam to the control point of Encuentros, kilometer 2,248, the route lies practically on the Continental Divide. The ascent begins almost immediately upon leaving Tecpam and the summit is reached at kilometer 2,217, elevation 9,900 feet (3,006 meters).

The present road from Tecpam to the summit is very circuitous, containing several switchbacks which

are dangerous to traffic. The grades are for the most part in excess of 7 percent.

In order to bring this section of road to the proper standards, relocation will be necessary. There is ample terrain for the desired development either to the right or left of the present road. The mountain slopes through here are steep and rocky, and new construction will be expensive. It would be possible to modify the existing grades and alinement so that the old road could be used temporarily with safety and comfort until such time as new construction would be warranted. Development to the left seems preferable.

From the summit at kilometer 2,217 to Encuentros there are many sharp curves and a few sections of excessive grade; however, as the road is following the ascents and descents of the Divide, there are no places where long supported grades occur. It is thought, therefore, that the practical procedure would be to reestablish line and grades along the present road.

Throughout the whole section from Tecpam to Encuentros the road is unsafe for two-way traffic. The surface is smooth and fine in dry weather but quite different when it rains. At one place near kilometer 2,229 there is a short section of well-constructed macadam. There is abundant material all along the road between the control points for satisfactory surfacing.

Going from Encuentros to the control point of Totonicapan, kilometer 2,287, the route continues near the crest of the Continental Divide to a summit at an elevation of 10,250 feet (3,105 meters), at kilometer 2,278, where it begins to descend into the drainage basin of the Rio Samala, which flows to the Pacific Ocean. At kilometer 2,268 an elevation of 3,200 meters is reached, which is the highest point on the route between Panama and Mexico.

The present road for 5 kilometers from Encuentros is a graded-earth section with a few sharp curves and some sections of grade in excess of 7 percent. It is of ample width for two-way traffic and can be traveled with safety at moderate speeds. This section could be much improved by a small amount of work.

Continuing to a summit at kilometer 2,278 the road section is narrow, there is excessive curvature at places, and some grades are above 7 percent, all of which could be brought to standard by slight deviations from the present road. Most of the objectionable features occur where the line crosses secondary ridges and at these points efforts have been made to shorten the line by using maximum gradients and short radius curves. A little greater development would remedy the existing conditions.

The descent from the summit at kilometer 2,278 to Totonicapan is abrupt and contains much curvature. It would be very expensive to change the location through here, and it is believed that the present road should be followed and improved by readjustments of

grade and curvature. In case it is desired to change the location, the line should leave the old road at the saddle at kilometer 2,277.5 and descend into Totonicapan to the right of the present road. Inspection indicates that good grades and alinement could be got on such a line, but at excessive cost.

The present road from a point 5 kilometers north of Encuentros to Totonicapan is narrow, and much rock was encountered in its construction. This is particularly true where the road deviates from the crest of the ridge and is on side hill. But the slopes of the mountains are not steep and consequently to widen the present road would not be unduly expensive.

The surface over this section is of natural material, containing a great deal of rock. It is, therefore, rough but passable throughout the year for almost the entire distance.

The route from Totonicapan to the control point of Quezaltenango, kilometer 2,316, follows down the Rio Samala Valley. This is one of the most thickly populated and intensely cultivated sections of the Republic. The present road is over 8 meters in width practically throughout the entire distance. It has no excessive curves or gradients with the exception of a short section leaving Totonicapan, which can be readily improved.

The surface permits a motor bus to operate throughout the entire year between Totonicapan and Quezaltenango. The natural soil seems to hold up exceedingly well under all weather conditions.

From Quezaltenango to the control point of San Marcos, kilometer 2,375, the line follows in close proximity to the old road along the Rio Samala Valley, crossing over to the drainage basin of the Rio Naranjo at the summit at kilometer 2,341. As far as San Juan Ostuncalco, along the Rio Samala Valley, there are no excessive grades, but the line is circuitous in places. This can be easily remedied without much cost. At San Juan Ostuncalco the line begins to climb to the divide between the Rio Samala and the Rio Naranjo, and from this divide to San Marcos there is much broken terrain due to crossing the many small streams that form the headwaters of the Rio Naranjo.

It is not thought, however, that much difficulty will be found in adjusting the excessive gradients and curvature of the present road to standard. It would be entirely feasible to go to the right from the summit at kilometer 2,341 to the summit at kilometer 2,342, thereby throwing the line higher up in the Naranjo basin. But this revision is not thought advisable as it would bypass the towns of San Antonio, San Pedro, and San Marcos. It is recommended that the old road be followed as closely as the standards will permit.

The surfacing from Quezaltenango to San Marcos is natural material, the road is narrow, and in places is

impassable in wet weather. Road material abounds throughout this section.

Between San Marcos and the control point of Malacatan, kilometer 2,429, and thence to the crossing of the Rio Suchiate at kilometer 2,443.5, the route follows up the basin of the Rio Naranjo to the gap at kilometer 2,385 where it passes over into the drainage basin of the Rio Cabus. (It might be well to mention that the Rio Naranjo could be followed down from San Marcos to Coatepeque and thence to Ayutla, but this would necessitate very heavy new construction.) The Rio Cabus Basin is followed to Malacatan from where the route cuts across the principal drainage to a point on the Rio Suchiate.

Instead of following via San Rafael down the ridge between two branches of the Rio Cabus, it might be well to investigate further the possibility of swinging to the right after passing through the gap at kilometer 2,385 and gradually descend to the Rio Cabus, thence following down its right bank to Malacatan.

While this is perfectly feasible, it would throw the road away from a very productive coffee country and the towns of San Rafael and Rodeo. It would also require the abandonment of much work that has recently been done between the gap and Malacatan. It is believed that a line near the old route should be seriously considered and utilized if possible.

The present road is narrow and rough, is constructed from San Marcos to a point past San Rafael, and from the Rio Cabus bridge to the Rio Suchiate bridge.

That part from San Marcos to the gap at kilometer 2,385 is of fair alinement and grade; from the gap to a point past San Rafael the grades are steep, curvature is excessive, and the construction heavy.

From the gap at kilometer 2,385 to San Rafael, however, the average grade closely approximates 7 percent and it is believed that with judicious adjustment of grades and alinement this section of road can be made serviceable. From San Rafael to Malacatan there is no difficulty in securing an excellent location by following down one of the branches of the Rio Cabus. From Malacatan to the Mexican border good grades and alinement are easy to secure; however, there are many small streams to cross.

The surface of the present constructed sections of road is of natural material and impassable in wet weather with the possible exception of that part from the summit at kilometer 2,385, to San Rafael. There is abundant surfacing material throughout the whole section.

Alinement.—Most of the present road through the Republic can be brought to the standard of alinement without a great amount of work. Usually this can be done by slight adjustments in grades in connection with those in alinement. In this way a great deal can

be utilized of the work that has been done in surfacing and otherwise improving the existing roads.

There are places where entire relocation will be necessary for short distances. Such is the case in the ascent from Tecpam to the summit near kilometer 2,217; from the gap near kilometer 2,277.5 to Totonicapan; from the summit at kilometer 2,385 to Malacatan and in several shorter stretches. A series of short revisions on the sections above mentioned and at other places will suffice to put the present road in usable condition without a great deal of expense.

There are many curves of short radii between San Juan Ostuncalco to San Marcos where the present road follows up the drainage basin of the Rio Samala and crosses over into that of the Rio Naranjo. These can be remedied by slight revision in alinement, for there is ample terrain for any amount of developing. This holds true in practically every instance along the route in Guatemala where excessive curvature on grades exists, and it is for this reason that a close study of the present road should be made by the locating engineer.

Gradients.—Practically the same condition holds with regard to gradients, because grades and alinement are particularly interdependent over terrain like that encountered in Guatemala. There will be many instances where the use of short lengths of 9-percent grade on direct alinement will save an entirely relocated road over considerable distance if a 7-percent grade is to be strictly adhered to. It is only in cases where long supported grades of the maximum percent appear on rugged mountain sides that the alinement has to suffer. But fortunately the longest stretches of ascent or descent along the present road are not made on uniform gradients and as a rule the maximum standard grade adopted will, if applied to these stretches, accomplish the differences in elevation with ease.

Mountains and valleys.—There are two prominent ridges crossed between the El Salvador border and the summit of the Continental Divide near Guatemala City. After leaving this point the Continental Divide is generally followed to San Marcos; however, there is a considerable rise from Guatemala City to the summit of a ridge just past San Rafael. From here to Tecpam there are no ridges of any consequence, but from this point the Continental Divide rises precipitately and maintains a high elevation until the descent to Totonicapan. From Totonicapan to San Marcos there is one distinct rise between the waters of the Rio Samala and those of the Rio Naranjo. Between San Marcos and the Mexican border there is a ridge that separates the waters of the Naranjo from those of the Rio Cabus.

There are no valleys followed for long distances, but those of the Rios Tamasulapa, Las Lajas, Esclavos, Samala, and Cabus are used locally.

Principal drainage.—The route beginning at the El Salvador border is drained by the Rio Tamasulapa into

Lake Guija, following which the principal drainage is all to the Pacific Ocean except at several places where the line bears to the Atlantic side of the Continental Divide. There are no large streams crossed that flow to the Atlantic, except in their extreme upper reaches. The largest of these at the road crossing are the Rio Santiago, a tributary of the Rio Sacatepequez, and a tributary of the Rio Grande which is crossed after leaving Tecpam.

Soil conditions.—Practically all of the geological formations of the mountainous section of Guatemala are of igneous origin. Usually the soil is very fertile, varying in its adaptability to different crops with the elevation, climatic conditions, and the length of time it has been under cultivation.

No difficulty should be encountered in securing stable subgrade for surfacing throughout the route in the Republic. There is ample natural material at all points for the construction of drainage structures and various types of pavement or surfacing. Cement, oils, and other manufactured and refined products would have to be largely imported.

Stone is plentiful of almost any desired grade and the streams that are crossed in their lower reaches, such as the Rio Tamasulapa, abound in sand and gravel. In the higher altitudes some difficulty will be had in obtaining sand of a high grade. However, unless a concrete pavement is used, there will be little need for sand as there are few stream crossings, and those are small.

The material and soil situation throughout the territory traversed by the line seems satisfactory.

Existing roads used.—As stated before there is a road through Guatemala from El Salvador to Mexico along the proposed route that is traversable with ease by automobile during the dry season. Some sections can be negotiated the year round. A large part of this road is located so that it is usable for the proposed highway. The existence of such a road bears evidence of its need and of the efforts that have been put forth from time to time for its improvement.

This makes the situation in Guatemala different from that in any of the other republics through which the reconnaissance was made, with the possible exception of Panama. The problem resolves itself into the utilization of as much of the present road as practicable by short relocations and revisions.

The gradual improvement of the existing highway system in Guatemala has been brought about by the desire to develop the agricultural resources of the country. Since the advent of motor transportation, improvements have been made with some consideration of the needs of motor transport. A considerable portion of the selected route has a section more than ample for safe two-way motor traffic, and some relocation has been made at various times to eliminate

excessive grades and bad curves. There remain, particularly in the mountainous country, sections which should be widened to conform with the minimum requirements for the proposed inter-American highway and dangerous curves which should be eliminated by relocation or realignment. Road-construction activities of the national authorities should be devoted to work of this sort until such time as a general reconstruction is provided for.

Estimates of cost.—Tables 16, 17, and 18 itemize the estimated costs on the principal phases of the operations in Guatemala.

The length of the proposed highway in Guatemala is 310.4 miles (499.5 kilometers).

All bridges are to be widened or built for a 20-foot roadway.

Estimates for type 1, table 16, contemplate using 118.4 miles of the present road which has an all-weather surface, but has some excessive grades. The surface is rough. They also contemplate the construction of 192 miles of road with a 28-foot graded section and a surfacing of local material 6 inches thick compacted and 18 feet wide.

Estimates for type 2, table 17, contemplate all under the type 1 road, but allow for resurfacing the 118.4 miles and oiling these in addition to the 192 miles of new construction.

Estimates for type 3, table 18, contemplate a new road with a graded section of 32 feet and a concrete paving 20 feet wide and 8 inches thick for 310.4 miles.

Principal stream crossings in Guatemala are shown in table 19, and the length of span is indicated for bridges not yet constructed.

TABLE 16.—*Estimates for type 1*

Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	300	Miles.....	\$200. 00	\$60, 000
Unclassified excavation.....	3, 000, 000	Cubic yards.....	1. 00	3, 000, 000
Small drains.....	63, 720	Linear feet.....	10. 00	637, 200
Bridges.....	4, 320	do.....	250. 00	1, 080, 000
Surfacing.....	450, 624	Cubic yards.....	2. 50	1, 126, 560
Total.....				5, 903, 760
Add 12½ percent for engineering and contingency.....				737, 970
Total estimate.....				6, 641, 730

TABLE 17.—*Estimates for type 2*

Item	Quantity	Unit	Unit cost	Amount
Oil.....	1, 638, 912	Gallons.....	\$0. 25	\$409, 728. 00
Type 1.....	(1)			5, 903, 760. 00
Additional surfacing.....	185, 500	Cubic yards.....	2. 50	463, 750. 00
Total.....				6, 777, 238. 00
Add 12½ percent for engineering and contingency.....				847, 154. 75
Total estimate.....				7, 624, 392. 75

1 All items.

TABLE 18.—*Estimates for type 3*

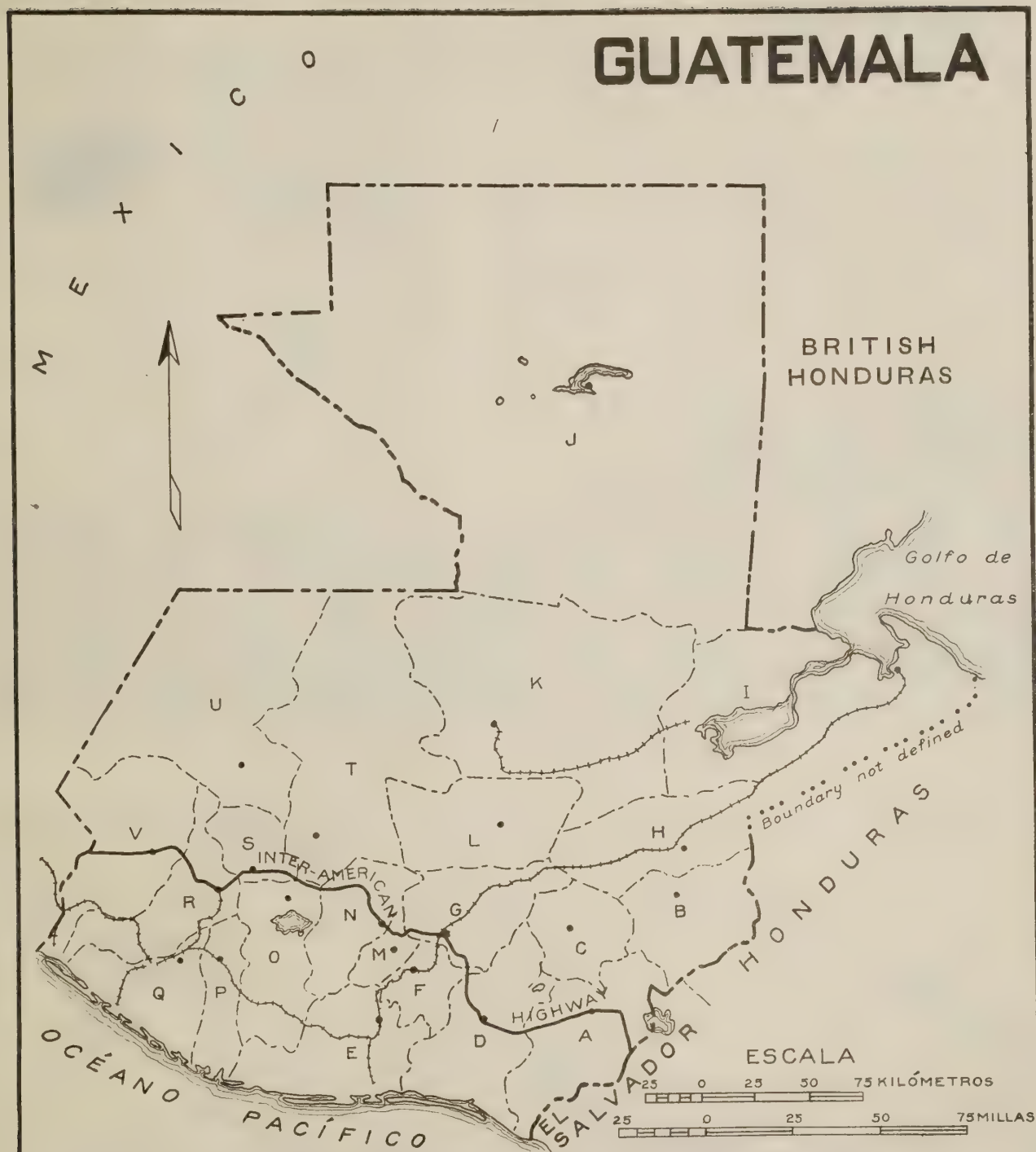
Item	Quantity	Unit	Unit cost	Amount
Clearing and grubbing.....	300	Miles.....	\$200.00	\$60,000
Unclassified excavation.....	6,000,000	Cubic yards.....	1.00	6,000,000
Small drains.....	75,000	Linear feet.....	10.00	750,000
Bridges.....	4,320	do.....	250.00	1,080,000
Surfacing.....	809,200	Cubic yards.....	15.00	12,138,000
Total.....				20,028,000
Add 10 percent for engineering and contingency.				2,002,800
Total estimate.....				22,030,800

TABLE 19.—*Principal stream crossings*

Name of stream	Length of bridge span	
	Feet	Meters
Rio Amatol.....	120	36
Rio Mongoy.....	150	46
Quebrada Quezalapa.....	60	18
Rio Tamasulapa.....	300	92
Quebrada Los Posos.....	40	12
Quebrada Asuncion Mita.....	60	18
Quebrada.....	40	12
Do.....	30	9
Rio Moron.....	60	18
Rio San Antonio.....	80	24
Quebrada Tejada.....	40	12
Rio de la Virgen.....	80	24
Rio Salado.....	120	36

TABLE 19.—*Principal stream crossings—Continued*

Name of stream	Length of bridge span	
	Feet	Meters
Brazo Rio La Paz.....	100	30
Quebrada Quebradona.....	60	18
Brazo Rio La Paz.....	60	18
Rio Blanco.....	80	24
Rio Malino.....	100	30
Rio Esclavos.....	450	137
Quebrada Quilapa.....	80	24
Rio Malpais.....	120	36
Rio Las Ventas.....	60	18
Rio Los Verdes.....	80	24
Rio Molino.....	120	36
Rio Santiago.....	80	24
Quebrada Sumpango.....	40	12
Quebrada.....	40	12
Quebrada Chirijuyu.....	40	12
Rio Xaya.....	80	24
Rio Xequijel.....	80	24
Do.....	120	36
Rio Salcaja.....	200	60
Rio Samala.....	120	36
Quebrada.....	60	18
Brazo Rio Samala.....	80	24
Brazo Rio Naranjo.....	60	18
Rio Naranjo.....	80	24
Quebrada.....	60	18
Rio Cabus (Brazo).....	60	18
Rio Mapa.....	60	18
Rio Cabus.....	120	36
Rio Nica.....	100	30
Rio Petacalapa.....	120	36
Rio Malacatillo.....	80	24
Rio Suchiate.....	150	46
Total.....	4,320	1,302



DEPARTAMENTO	CAPITAL	DEPARTAMENTO	CAPITAL
A JUTIAPA	JUTIAPA	L BAJA VERAPAZ	SALAMÁ
B CHIQUIMULA	CHIQUIMULA	M SACATEPÉQUEZ	ANTIGUA
C JALAPA	JALAPA	N CHIMALTENANGO	CHIMALTENANGO
D SANTA ROSA	CUAJINIKILAPA	O SOLOLÁ	SOLOLÁ
E ESCUINTLA	ESCUINTLA	P SUCHITEPEQUEZ	MAZATENANGO
F AMATITLÁN	AMATITLÁN	Q RETALHULEU	RETALHULEU
G GUATEMALA	GUATEMALA	R QUETZALTENANGO	QUETZALTENANGO
H ZACAPA	ZACAPA	S TOTONICAPÁN	TOTONICAPÁN
I IZABAL	PTO BARRIOS	T EL QUICHÉ	STA. CRUZ QUICHÉ
J EL PETÉN	FLORES	U HUEHUETENANGO	HUEHUETENANGO
K ALTAVERAPAZ	COBÁN	V SAN MARCOS	SAN MARCOS



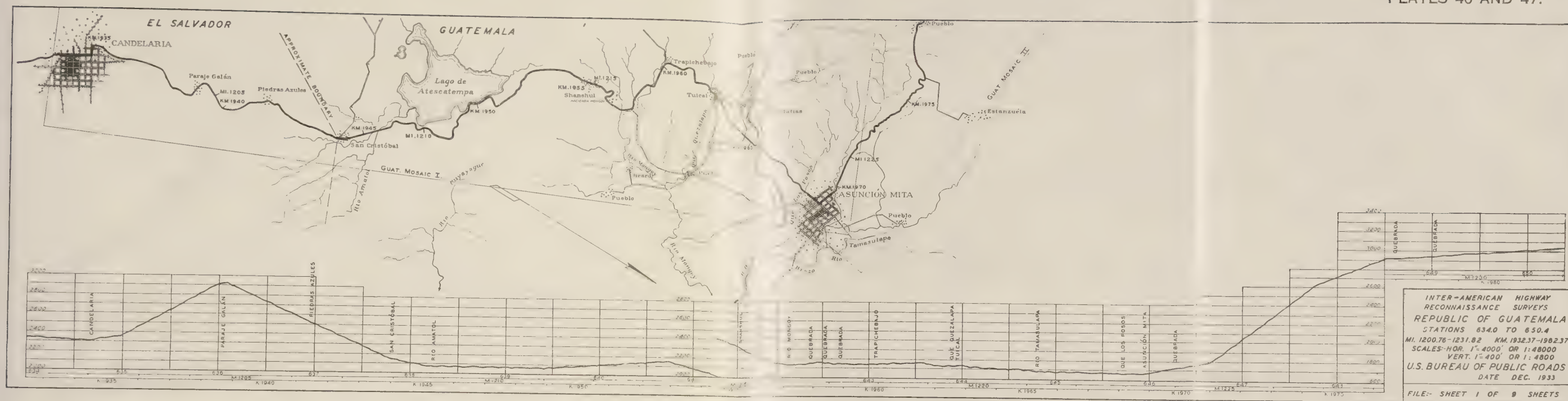


PLATE 46.

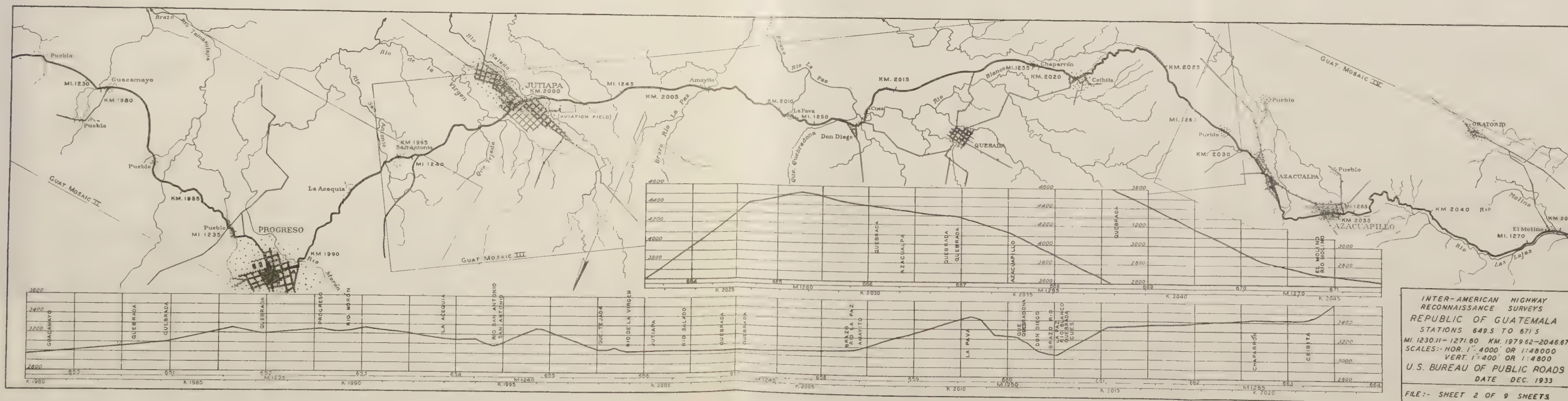


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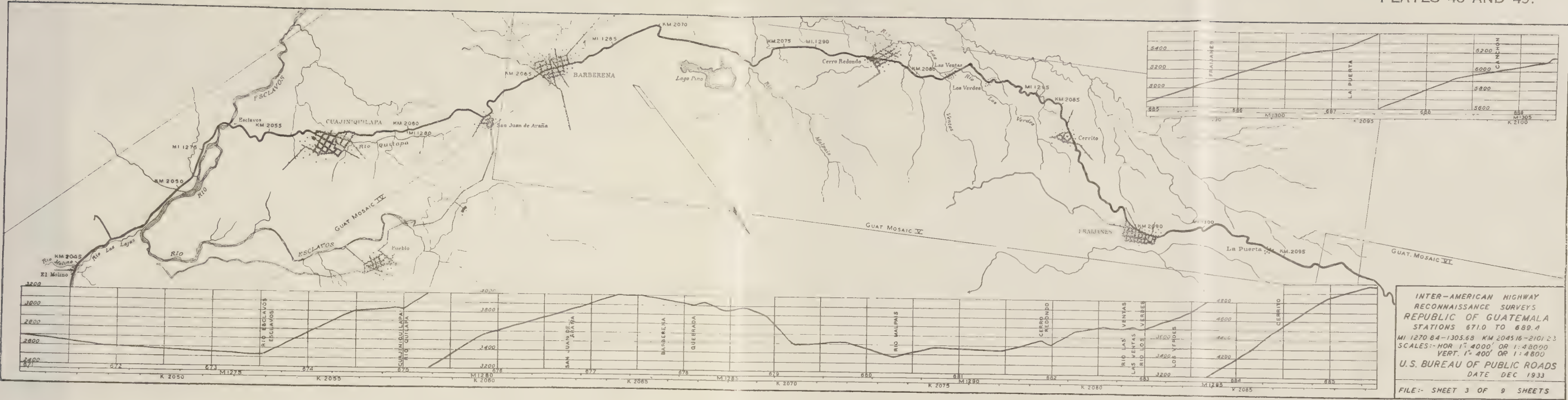


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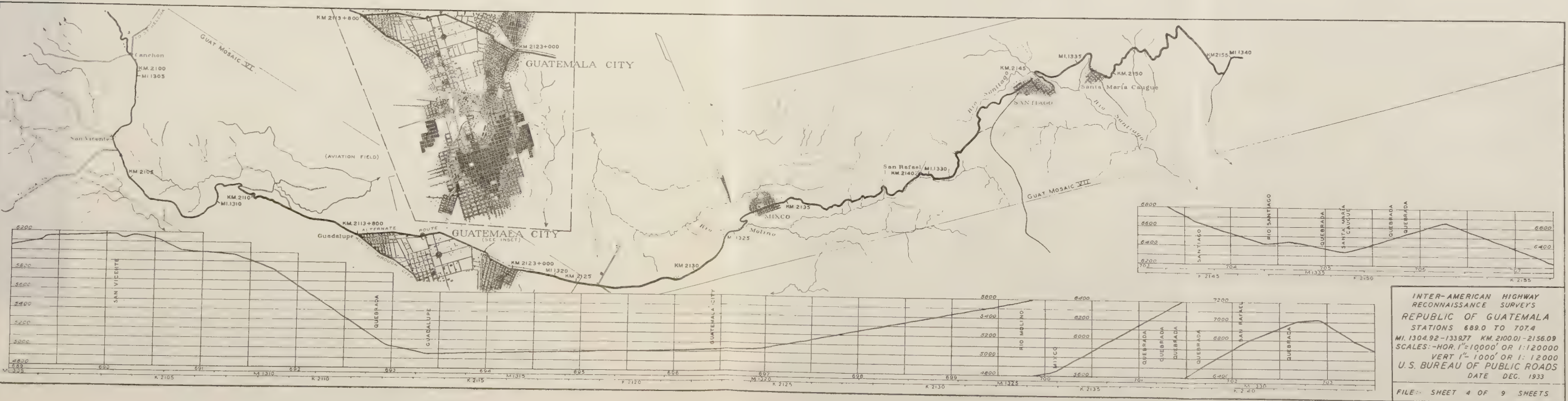


PLATE 49.

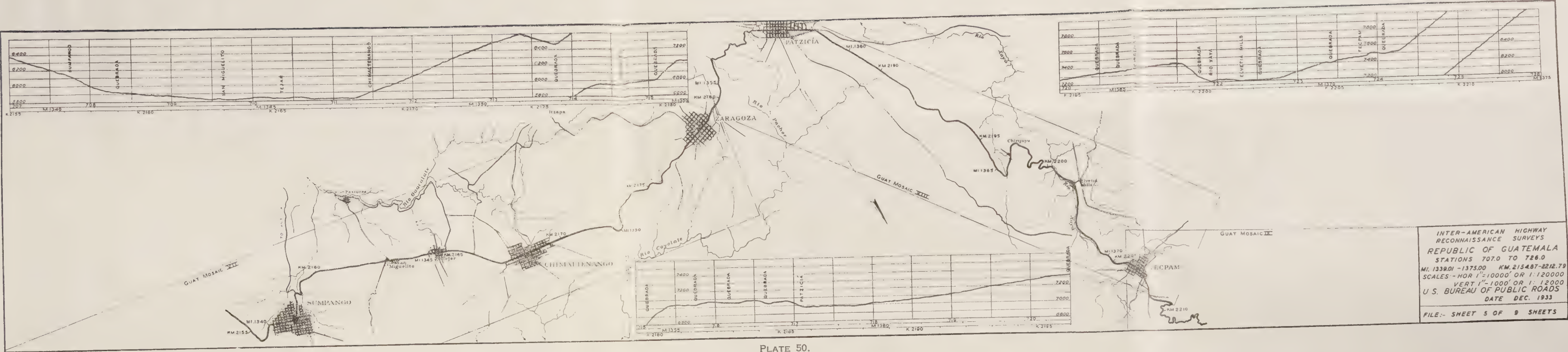


PLATE 50.

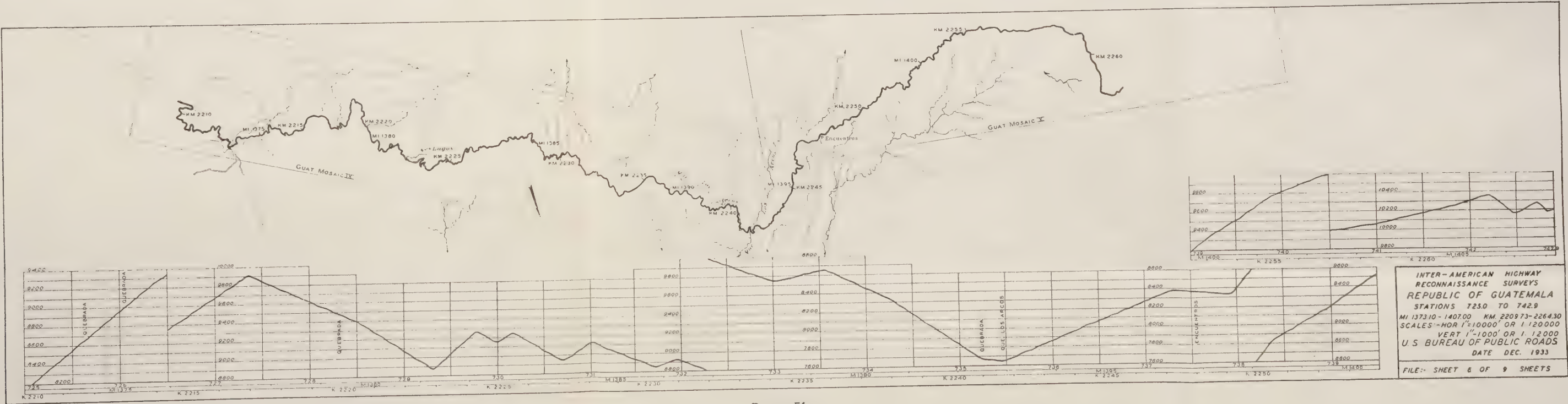


PLATE 51.

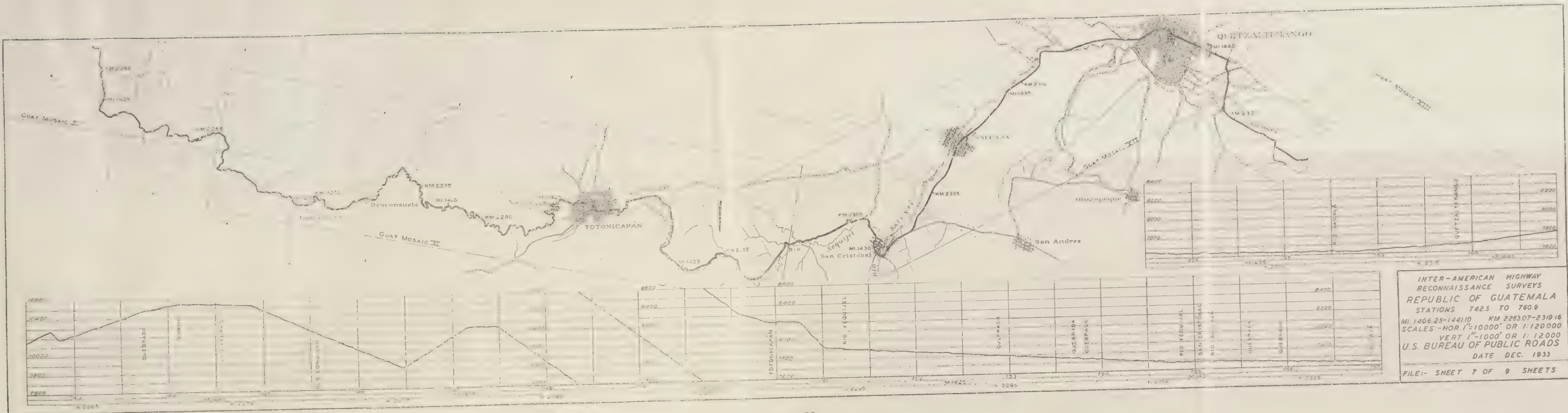


PLATE 52.

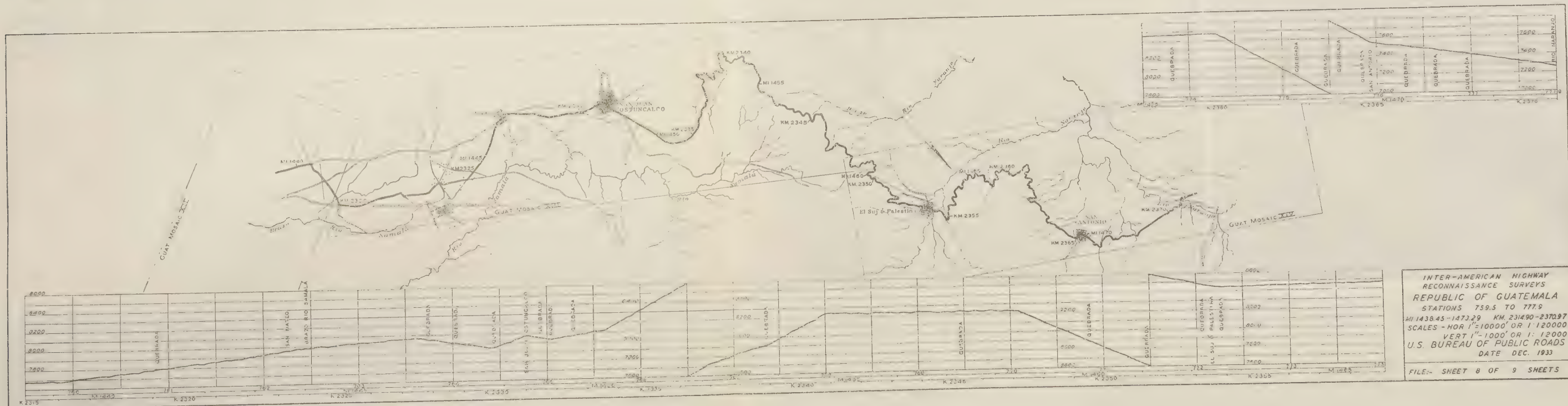
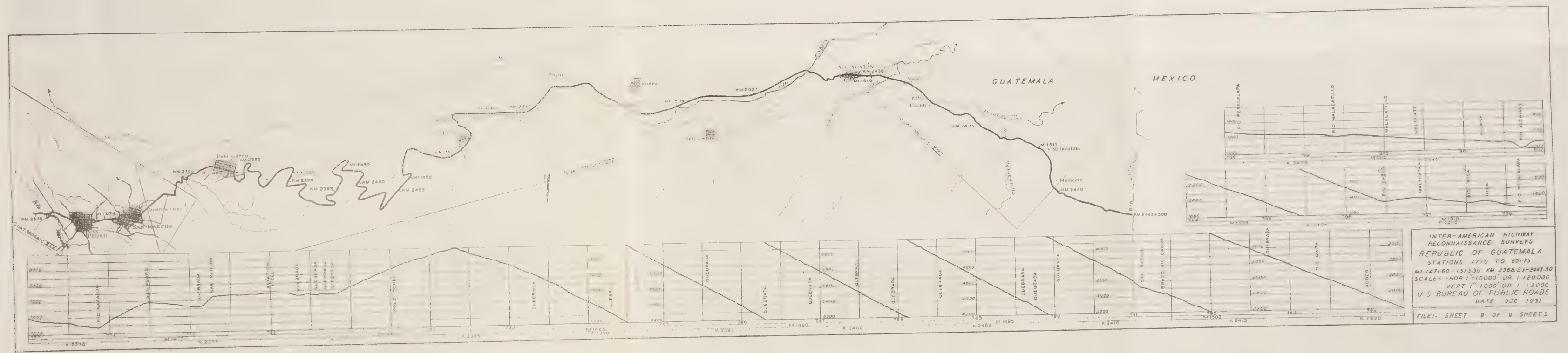


PLATE 53.



MEXICO

For several years the Republic of Mexico has been engaged in a systematic and farsighted program of highway construction. Started in the administration of President Elias Calles, the work has been vigorously pushed until a modern road passable in all seasons will soon be open from the Rio Grande to Mexico City. At the end of 1933, 662 miles of the total distance of approximately 775 miles between Nuevo Laredo and Mexico City were already open to all-weather motor traffic, and cars and trucks, many of them from the United States, were regularly operating between Nuevo Laredo and Ciudad Victoria. Surveys and intermittent construction have been undertaken south of Puebla, but neither the surveys nor the grading are completed to the Guatemala line.

When Panama invited the several countries to send representatives to Panama City to attend the first conference on the inter-American highway in October 1929, the Mexican Government advised that its purpose and plans were already fixed, with as much definiteness as conditions permitted, to construct a longitudinal road from the United States to Guatemala, and that such highway would obviously become a link in any contemplated route throughout the Republics. Accordingly, Mexico did not make request for a reconnaissance and no survey was made north of the Suchiate River.

The line of the proposed longitudinal road in Mexico has been fixed definitely as far south as Tehuacan and the general route is known from that place to Oaxaca and Mitla, following existing roads. Beyond Mitla the location has been studied as far as the Guatemala boundary at the Suchiate River, but some sections have not yet been thoroughly reconnoitered, especially

between Comitán via Tapachula to the border. Through some sections, principally in the vicinity of the larger centers of population such as Juchitán and Tuxtla Gutiérrez, there are already some graded sections; and elsewhere there are old roads which will be followed generally, but much remains to be done before wheeled vehicles will be able to proceed beyond Mitla on a continuous trip.

In order to show the condition of the route through Mexico, there is attached a more or less detailed statement furnished through the courtesy of the Mexican highway officials. Distances south of Puebla are approximate only, indicating that the total distance through Mexico is about 1,740 miles (2,785 kilometers).

TABLE 1.—*Distances and conditions from the Rio Suchiate to Mexico City and Nuevo Laredo*

Place	Distance from Panama		Condition
	Miles	Kilometers	
Rio Suchiate.....	1,527.2	2,443.5	
To: Tapachula.....	1,555.5	2,488.9	No trail.
Tuxtla Gutiérrez.....	1,763.7	2,821.9	Trail.
Arriaga.....	1,847.6	2,956.2	Earth road.
Oaxaca-Chiapas line.....	1,860.9	2,977.4	Trail.
Zanatepec.....	1,894.7	3,031.5	Do.
Juchitán.....	1,940.6	3,104.9	Do.
San Jerónimo.....	1,951.1	3,121.7	Gravel road.
Tehuantepec.....	1,975.1	3,160.1	Trail.
Rio Tehuantepec.....	2,082.1	3,331.3	No trail.
Mitla.....	2,109.1	3,374.5	Earth road.
Oaxaca.....	2,133.1	3,412.9	Do.
Tehuacan.....	2,333.7	3,733.9	Do.
End of gravel road.....	2,365.8	3,785.3	Gravel surface.
Beginning of pavement.....	2,405.9	3,849.4	Graded.
Puebla.....	2,408.8	3,854.1	Paved.
Mexico City.....	2,492.7	3,988.4	Do.
Near Yolotepec.....	2,576.5	4,122.5	Do.
Yacala.....	2,660.3	4,256.5	Partly graded.
Tamazunchale.....	2,727.4	4,363.9	Under construction.
Valles.....	2,795.7	4,473.1	Gravel road.
Near Llera.....	2,898.8	4,638.0	Narrow gravel surfacing.
Victoria.....	2,938.3	4,701.4	Gravel road.
Near Rio Montemorelos.....	3,068.4	4,909.6	Do.
Monterrey.....	3,117.9	4,988.8	Paved.
Nuevo Laredo.....	3,265.4	5,224.8	Do.

APPENDIXES

APPENDIX A

ACTIVITIES OF THE UNITED STATES GOVERNMENT AND COOPERATING AGENCIES

BEGINNING OF CONTACTS

A resolution was adopted at the Fifth International Conference of American States held at Santiago, Chile, April 1923. Delegates from 18 American republics besides the United States were present and the following resolution was passed:

That there be convened at a date and place to be determined by the governing board of the Pan American Union a conference on automobile highways to study measures best adapted to developing an efficient program for the construction of automobile highways within the different countries of America and between these different countries.

This resolution was discussed by the representatives of the Pan American Union, the Departments of Commerce and Agriculture of the United States, the North American Board of Highway Education, the National Automobile Chamber of Commerce, and other groups interested in highway transportation. As a result of these discussions it was decided, as a preliminary step, to issue an unofficial invitation to Latin American officials interested in highway problems to visit the United States for the purpose of making an intensive study of highway and transportation problems and to exchange and discuss professional data and experiences in road building, and also to outline and submit to the Pan American Union a tentative program for the conference which had been agreed upon at Santiago.

Latin American Highway Commission, June 1924.—The Highway Education Board of the United States issued the afore-mentioned invitations with the result that 38 leading Government engineers, economists, and other officials representing 20 Latin American countries made a trip of inspection over the United States system of highways.

States visited: Illinois, Kentucky, Michigan, Minnesota, North Carolina, New Jersey, New York, Ohio, Pennsylvania, and Wisconsin.

The Highway Education Board was composed of the following:

Dr. J. J. Tigert, United States Commissioner of Education, chairman.

Mr. Thomas H. MacDonald, Chief, Bureau of Public Roads.

Lt. Col. Henry C. Jewett, Corps of Engineers, United States Army.

Mr. Roy D. Chapin, automobile industry.

Mr. H. S. Firestone, rubber industry.

Mr. B. B. Bachman, Society of Automotive Engineers.

Dean F. L. Bishop, Society for the Promotion of Engineering Education.

The following countries were represented by engineers on the Latin American Highway Commission: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

As a result of this meeting of the Latin American Highway Commission, the Pan American Confederation for Highway Education was organized, being an international organization having for its object the study and promulgation in the different countries constituting the Pan American Union of fundamental principles that contribute to the development of adequate highways.

First Pan American Congress of Highways, 1925.—Authority for participation by the United States in the First Pan American Congress of Highways was provided by Public Resolution No. 72, Sixty-eighth Congress (S.J.Res. 190), as follows:

JOINT RESOLUTION TO PROVIDE FOR THE EXPENSES OF DELEGATES OF THE UNITED STATES TO THE PAN AMERICAN CONGRESS OF HIGHWAYS

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States is hereby authorized to appoint delegates to enable the United States to participate in the Pan American Congress of Highways to meet at Buenos Aires in 1925, and for the expenses of the United States in participating in such conference, including the compensation of employees, travel, and subsistence expenses (notwithstanding the provisions of any other act), and such miscellaneous and other expenses as the President shall deem proper, there is hereby authorized to be appropriated the sum of \$15,000.

Approved March 4, 1925.

In the summer of 1925 the following delegates were appointed by the President on recommendation of the Secretaries of Agriculture, Commerce, and State, and the director general of the Pan American Union:

Mr. H. H. Rice, chairman, representing the National Automobile Chamber of Commerce.

Mr. Thos. H. MacDonald, Chief, United States Bureau of Public Roads.

Mr. Frank Page, chairman, State Highway Department, Raleigh, N.C.

Mr. Charles M. Babcock, representing the American Association of State Highway Officials.

Dr. A. N. Johnson, dean of engineering, University of Maryland, representing educators.

Mr. Wm. E. Hull, Member of Congress from Illinois.

Mr. Pyke Johnson, executive secretary.

Mr. Guillermo A. Sherwell, Inter-American Highway Commission.

The delegation sailed for Buenos Aires on September 3, 1925, and attended the first Pan American Highway Congress at Buenos Aires, Argentina, October 3-13, 1925.

Pan American Congress of Journalists.—At a meeting of the temporary executive committee of the Pan American Confederation for Highway Education on January 26, 1926, it was decided to assume responsibility for a trip of the Latin American delegates to the Pan American Congress of Journalists from New York to the Central West during the months of April and May 1926.

Purpose: To give the journalists an opportunity to see something of the social and industrial life of the United States and to bring about a better understanding of highway transportation and other problems of the day in this country.

Committee on Pan American Relations.—At a meeting of the Highway Education Board on November 30, 1926, the following resolution was passed:

Resolved, That a standing committee on Pan American relations be created with Dr. Rowe as chairman, and with other members as follows: Mr. Wilbur J. Carr, Mr. J. Walter Drake, Mr. Thos. H. MacDonald, Mr. Roy D. Chapin, Mr. Fred I. Kent, Mr. W. O. Rutherford.

Tour of Pan American business men.—It was suggested by Dr. Rowe at the meeting of the Highway Education Board on November 30, 1926, that an invitation be issued by the board to leading business men in Latin America to make a tour through the eastern industrial section of the United States directly after the close of the Third Annual Pan American Commercial Convention to be held in Washington, May 2, 1927.

On May 13 the delegates comprising the Latin American business men's tour left Washington as guests of the Highway Education Board for a 2 weeks' trip by highway and railroad through the agricultural and industrial centers of the eastern and central sections of the United States.

Purpose: To acquaint delegates with industrial and social conditions in the United States and give them an opportunity to exchange views with business men of the United States on questions of mutual interest.

Sixth International Conference of American States.—The Sixth International Conference of American States was held at Habana, Cuba, January and February 1928, and on February 7 passed the following resolution:

To recommend to the Pan American Congress of Highways, which will be held in Rio de Janeiro in July of the present year, the consideration and adoption of agreements looking to the construction of a road of longitudinal communication across the continent, taking up and deciding all questions relative to studies, route, branch connections, technical and economic co-operation of the different countries, and all other matters involved in the solution of such problems.

The Pan American Union shall be charged with the assembling of informative data and with the preparation of projects that may lead to the most efficient carrying out of the present resolution, bringing them in due time to the notice of the Pan American Congress of Highways above referred to.

On February 15 the following resolution was passed by the conference:

To give its full approval to the initiative for the building of an inter-American highway and to recommend to all governments, members of the Pan American Union, that they co-operate, insofar as possible, in the prompt realization of the said project.

Legislation authorizing reconnaissance survey of proposed inter-American highway.—Joint resolution (Public Resolution No. 104, 70th Cong., H.J. Res. No. 355, Cole bill) authorizing the appropriation of the sum of \$50,000 to enable the Secretary of State to cooperate with the several governments, members of the Pan American Union, furthering the building of an inter-American highway or highways:

Whereas the Sixth International Conference of American States, by resolution adopted at Habana, on February 7, 1928, intrusted the Pan American Union with the preparation of projects for the construction of an inter-American highway; and

Whereas the governing board of the Pan American Union, acting through the Pan American Confederation for Highway Education, has requested the cooperation of the several Governments, members of the Union, in the formulation of such projects; and

Whereas the Congress of the United States of America, by joint resolution approved May 4, 1928, requested the President to direct the several agencies of the Government to cooperate with the States, members of the Pan American Union, in the preparation of such projects; Therefore be it

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby authorized to be appropriated, out of any moneys in the Treasury not otherwise appropriated, the sum of \$50,000 to enable the Secretary of State to cooperate with the several Governments, members of the Pan American Union, when he shall find that any or all of such States having initiated a request or signified a desire to the Pan American Union to cooperate, in the reconnaissance surveys to develop the facts and to report to Congress as to the feasibility of possible route, the probable cost, the economic service and such other information as will be pertinent to the building of an inter-American highway or highways, to be expended upon the order of the Secretary of State, including the additional cost incident to the assignment by the President of personnel in the Government service, as now authorized, additional compensation of such personnel for foreign service, compensation of employees, transportation and subsistence, or per diem in lieu of subsistence (notwithstanding the provisions of any other Act), stenographic and other services by contract if deemed necessary, and such other expenses as

may be deemed necessary by the Secretary of State in furtherance of the projects described.

Approved March 4, 1929.

The \$50,000 authorized by the above legislation was carried in the budget of the State Department for the fiscal year 1930.

Joint resolution (Public Resolution No. 40, 70th Cong., H.J.Res. No. 259, McLeod bill) authorizing assistance in the construction of an inter-American highway on the Western Hemisphere:

Whereas the Sixth International Conference of American States, at Habana, Cuba, resolved as follows:

To recommend to the Pan American Congress of Highways, which will meet at Rio de Janeiro in July of the present year, the consideration and adoption of agreements that will be conducive to the construction of a longitudinal communication highway to traverse the continent, taking into consideration and deciding all questions relative to studies, route, branch connections, technical and economical cooperation of the different countries, and other matters included in the determination of this problem.

The Pan American Union is entrusted with the compilation of information and the preparation of projects which will serve to give effect to this resolution, submitting this material in due time to the Pan American Congress of Highways.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Government of the United States should manifest the utmost interest in the purposes of the aforesaid resolution, and that in order to promote the speedy realization of these purposes and objects the President is requested to direct the several agencies of the Government, and they are hereby authorized to lend such cooperation and assistance as may be feasible and appropriate with a view to having the matter thoroughly considered by the approaching Conference; and he is further requested to advise Congress of any conclusions reached and any action which may be suggested by the Conference.

Approved May 4, 1928.

Second Pan American Congress of Highways at Rio de Janeiro, Brazil, August 16-31, 1929.—The United States was authorized to participate in the Second Pan American Congress of Highways at Rio de Janeiro, Brazil, by Public Resolution No. 24, Seventieth Congress (S.J.Res. No. 30) as follows:

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of \$15,000 for the expenses of participation by the United States in the Second Pan American Conference on Highways at Rio de Janeiro, including the compensation of employees, transportation, subsistence or per diem in lieu of subsistence (notwithstanding the provisions of any other Act), including expenses of delegates in visiting Colombia and Venezuela in connection with the Conference, and such miscellaneous and other expenses as the President shall deem proper.

Approved April 3, 1928.

The following official delegates were appointed by the President on July 12, 1929, to represent the United States at the Second Pan American Congress of Highways:

Mr. J. Walter Drake, chairman, Detroit, Mich., former Assistant Secretary of Commerce.

Mr. H. H. Rice, Detroit, Mich., assistant to the president, General Motors Corporation; chairman, United States delegation to the First Pan American Congress of Highways.

Hon. Tasker L. Oddie, United States Senator from Nevada.

Hon. Cyrenus Cole, Member of Congress from Iowa.

Mr. Thomas H. MacDonald, Chief, Bureau of Public Roads.

Mr. Frank T. Sheets, Springfield, Ill., Chief Engineer, Department of Public Works and Buildings.

Mr. Frederic A. Reimer, consulting engineer and president of the American Road Builders Association.

In accordance with the resolutions passed by the Sixth International Conference of American States a preliminary report on the proposed Pan American highway was prepared by the Executive Committee of the Pan American Confederation for Highway Education and transmitted by the Pan American Union to the Second Pan American Congress of Highways convened at Rio de Janeiro, August 16-31, 1929.

Of the conclusions reached by this Congress, the following have the most direct and important bearing on the matter of the development of inter-American highway systems:

The Congress considers it indispensable, in order to realize the objectives of the Pan American Union, and for the efficient and economic development of the roads; that every country should prepare a complete study of its highway system plan, in order to meet the needs of intercommunication of its political subdivisions, and to provide the most convenient junction with the highway system of the neighbor countries.

The Congress considers it necessary that the construction of new highways should follow closely a well studied program, continuously maintained, so as to lend to this public work the necessary uninterrupted execution. This is an important factor in the reduction of cost of the construction.

The Congress considers that the convenient and continuous maintenance of highways is an essential condition for their satisfactory use in transport. In order that this maintenance be economical and useful, it is necessary that it be executed by permanent technical experts, supplied with the necessary up-to-date mechanical equipment. Special care should be given to this class of work during the rainy season in order to overcome the effect of moisture of the soil and provide the necessary drainage.

The Congress, considering that the international system of road signs does not meet the requirements of modern traffic, recommends that the Pan American Union, in cooperation with the several countries, members of the Union, and with other duly organized institutions, shall cause a study to be made of the system of highway warning and direction signs at present in use, and a project prepared of a uniform international code for such signals for adoption by the countries, members of the Pan American Union, to be submitted to the Sixth International Highway Congress to convene at Washington in 1930.

The Congress resolves:

1. To approve and transmit to the Pan American Union the appended draft of principles for the control and regulation of automotive traffic within the republics of the American Continent, in order that the Governing Board of the Pan American Union may, pursuant to the terms of the resolution of the Sixth International Conference of American States, transmit such principles to the Governments, members of the Union.

2. To request the Governments of the countries, members of the Pan American Union, to incorporate the principles contained in the appended draft in their legislation governing automotive traffic, in order that uniformity may be achieved in this important matter.

The Congress resolves:

(a) To recommend to the governments represented in this Congress, that when planning or increasing its systems of improved highways, they should adopt the scheme that is most convenient for international connections, also that when carrying out the construction they should give preference, as much as possible, to said connecting highways.

(b) To consider as international highways those which connect capitals of countries, and for the purpose of establishing the Pan American Highway System, to request the government of interested countries to send as quickly as possible the plans of those highways which should be considered international, to the Pan American Union. This institution should be kindly asked to undertake this important work.

First Inter-American Highway Congress, Panama, October 7-12, 1929.—At the invitation of the Republic of Panama the delegation was instructed by the Secretary of State of the United States to attend a meeting at Panama for the purpose of discussing a possible route for a highway.

The following representatives of the United States attended the meeting:

Hon. John Glover South, Minister to Panama.

Mr. J. Walter Drake, chairman of the delegation to the Second Pan American Congress.

Mr. H. H. Rice, chairman of the delegation to the First Pan American Congress.

Mr. T. H. MacDonald, Chief, United States Bureau of Public Roads.

Mr. E. W. James, Chief, Division of Highway Transport, United States Bureau of Public Roads.

Mr. Pyke Johnson, executive secretary of the first and second delegations.

This meeting was also attended by delegates from the following countries: Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Canal Zone.

The following resolutions were adopted by the Congress:

1. To recommend the immediate provision of a vehicular crossing of the Panama Canal and Zone, at all times adequate for the traffic.

2. First, to recommend to the Pan American Union, through the Pan American Confederation for Highway Education to appoint a commission consisting of from three to eight members to be designated as the Inter-American Highway Commission. The governments interested may be represented by delegates appointed by them.

This Commission shall meet as often as may be necessary and may do business once the majority of its members are present.

The Inter-American Highway Commission shall start work as soon as possible. The Commission shall render detailed reports of the result of its works, and copy of such reports shall be delivered to each of the governments interested.

Second. To recommend to the Governments of the Republics of Panama, Costa Rica, Nicaragua, Honduras, Salvador, Guatemala, Mexico, and the United States of America, to cooperate with the Inter-American Highway Commission and facilitate its work, furnishing all possible facilities on the works that are

carried out in their respective territories in the accomplishment of its mission; such assistance to be made with either engineers, assistants, transportation means, subsistence, etc.

Third. To recommend to the Pan American Union that as soon as the favorable moment arrives and as often as circumstances may justify it, promote meetings of representatives duly accredited by the countries interested in the Inter-American Highway so that they can make any necessary international agreements in each case, having as a basis thereto the work previously done and the reports submitted by the Inter-American Highway Commission.

Fourth. To ask the Pan American Union to obtain through the Inter-American Highway Commission or through other means, approximate data resulting from a probable preliminary estimate relative to the probable cost of the highway in each Central American Republic, so that the financial problems may be considered simultaneously with the technical studies.

3. To make record of the interesting suggestions concerning the financing of the Inter-American Highway which are contained in the opening speech of the President of the Conference and to forward such suggestions to the Inter-American Highway Commission as soon as the same is created.

4. To recommend to the Pan American Union that it in turn recommend to each of the countries between Panama and the United States that within a period of 5 years they construct a road suitable for vehicular transit between the two countries.

International conventions.—In accordance with the resolution adopted at the Second Pan American Congress held in Rio de Janeiro, Brazil, August 1929, a meeting of representatives of Central and South America and of the United States was held at the Pan American Union in Washington, D.C., on October 4, 1930. On October 6 the Convention on the Regulation of Automotive Traffic, providing for uniform control of international automotive travel, was signed by the following 19 States:

For Argentina:

J. A. Valle.

Jose I. Girado.

For Bolivia:

Geo. de la Barra.

For Brazil:

S. Gurgel do Amaral, president of delegation from Brazil, ad referendum of Governor of Brazil.

G. M. deMenezes.

S. Arnaldo A. da Motta.

For Chile:

Alberto Fernandez R.

O. Tenham V.

For Colombia:

Carlos de Narvaez.

Enrique Coronado Suarez.

For Costa Rica:

J. P. Arango.

For the Dominican Republic:

Persio C. Franco, ad referendum.

For Ecuador:

Homeri Viteri L.

For Guatemala:

Adrian Recinos.

Ramiro Fernandez.

Ed. Jeanneau.

For Honduras:

Felix Canales Salazar.

For Mexico:

A. Becerril Colin.
Leopoldo Farias.

For Nicaragua:

Juan B. Sacasa.

For Panama:

J. R. Guizado.

For Paraguay:

Pablo M. Ynsfran.

For Peru:

Eduardo Dibos D.

For El Salvador:

Julio E. Mejia.
F. A. Reyes, h.

For Uruguay:

Mario Coppetti.
Juan P. Molfino.
Carlos A. Rabassa.

For Venezuela:

Fco. J. Sucre.

For the United States of America:

J. Walter Drake.

The convention is published in pamphlet form by the Pan American Union.

Establishment of Panama office.—Authority was carried in the first deficiency bill, Seventy-first Congress, Public 78, dated March 26, 1930 to establish an office on the Isthmus of Panama to cooperate with the several governments, members of the Pan American Union, in furthering the building of an inter-American highway or highways.

On June 19, 1930 the Department of State informed this office of the President's approval of the designation of a technical committee to cooperate with the several governments in reconnaissance surveys pertaining to the building of an inter-American highway.

Inter-American Highway Commission.—On January 10, 1931, the following United States members were appointed by the State Department on the Inter-American Highway Commission, in accordance with the resolution adopted by the First Inter-American Highway Congress held at Panama October 1929:

Mr. Thomas H. MacDonald, Chief, Bureau of Public Roads, chairman.

Mr. J. Walter Drake, formerly Assistant Secretary of Commerce and chairman of the delegation to the Second Pan American Congress.

Mr. W. R. Ely, chairman, State highway commission, Austin, Texas.

Mr. Harry Chandler, publisher, Los Angeles Times.

Panama meeting.—A meeting of the representatives on the Inter-American Highway Commission of the

several different countries was called by the Government of Panama for March 16, 17, and 18, 1931.

On March 5, 1931, the Secretary of State delegated authority to Mr. Thomas H. MacDonald and Judge W. R. Ely, members of the Inter-American Highway Commission, and Mr. Pyke Johnson, secretary, to attend the meeting.

The following officers were appointed for the Inter-American Highway Commission:

Mr. Tomas Guardia, chairman of the Commission.

Mr. Jacinto P. Arango, vice chairman.

Mr. Thomas H. MacDonald, secretary-treasurer.

APPENDIX B

CALENDAR OF SURVEY ACTIVITIES

April 6, 1929. Guatemala makes request to participate in an inter-American reconnaissance survey.

June 11, 1929. Nicaragua makes request to participate in an inter-American reconnaissance survey.

March 26, 1930. Congress of the United States appropriates \$50,000 for reconnaissance of routes.

June 1930. Engineers go to Panama, open office, and begin survey.

July 14, 1930. Panama makes request to participate in an inter-American reconnaissance survey.

September 3, 1930. Honduras makes request to participate in an inter-American reconnaissance survey.

September 23, 1930. Field reconnaissance starts in Panama.

October 1930. Field reconnaissance starts in Honduras.

December 1930. Aerial survey begins in Panama.

February 24, 1931. Costa Rica makes request to participate in an inter-American reconnaissance survey.

March 1931. Second Inter-American Highway Conference meets at Panama.

March 1931. Field reconnaissance starts in Guatemala.

April 27, 1931. Field reconnaissance starts in Costa Rica.

July 1931. Aerial survey begins in Costa Rica.

December 1931. Aerial survey begins in Nicaragua.

December 1931. Aerial survey begins in Honduras.

December 1931. Aerial survey begins in Guatemala.

January 15, 1932. Field reconnaissance starts in El Salvador.

December 15, 1932. Field reconnaissance starts in Nicaragua.

December 17, 1932. Engineers leave Panama for final conferences in Costa Rica.

January 1, 1933. Engineers return to Panama.

January 23, 1933. Engineers leave Panama for final conferences in Guatemala.

February 8, 1933. Engineers return to Panama.

April 23, 1933. Engineers make final check in interior of Panama.

May 3, 1933. Engineers return to Panama from the interior.

May 21, 1933. Engineers sail from Cristobal for New York after closing Panama office and shipping effects and records to Washington.

May 29, 1933. Engineers arrive in New York.

June 2, 1933. Engineers arrive in Washington.

APPENDIX C

Trade between the United States and the republics of Central America and Panama¹

TABLE 1.—Panama

UNITED STATES DOMESTIC EXPORTS TO PANAMA

Product	1928	1929	1930	1931	1932
Animals and animal products:					
Edible.....	\$2,565,706	\$3,092,203	\$2,745,566	\$2,202,131	\$1,811,055
Inedible.....	792,931	1,096,023	736,018	557,372	286,687
Vegetable food products and beverages.....	7,625,013	9,115,727	8,365,167	3,279,955	1,816,772
Vegetable products, inedible, except fibers and wood.....	1,659,284	2,188,662	2,017,757	1,409,374	1,185,884
Textiles.....	2,474,768	3,323,195	2,851,329	2,297,660	1,558,679
Wood and paper.....	1,373,610	1,829,489	1,565,955	1,087,563	604,767
Nonmetallic minerals.....	8,117,625	7,427,697	6,238,158	4,584,086	2,231,720
Metals and manufactures, except machinery and vehicles.....	2,523,058	3,113,667	2,775,197	2,105,022	1,738,486
Machinery and vehicles.....	4,110,975	6,392,205	5,375,475	3,386,078	2,248,980
Chemicals and related products.....	1,514,783	1,800,007	1,477,274	1,279,490	1,094,015
Miscellaneous.....	1,248,806	1,500,304	1,544,210	1,208,035	918,991
Total ²	34,006,559	40,879,179	35,692,106	23,396,666	15,496,036

UNITED STATES IMPORTS FROM PANAMA

Animals and animal products:					
Edible.....	\$5,912	\$8,821	\$1,981	\$9,549	\$1,883
Inedible.....	219,397	250,074	257,170	84,839	19,989
Vegetable food products and beverages ³	5,636,919	4,342,543	3,737,847	3,914,328	3,133,422
Vegetable products, inedible, except fibers and wood.....	257,561	180,535	102,206	46,913	2,673
Textiles.....	8,501	32,554	5,286	1,776	2,980
Wood and paper.....	8,788	11,064	29,774	17,730	31,633
Nonmetallic minerals.....	1,542	8,929	1,144	181	4,059
Metals and manufactures, except machinery and vehicles.....	19,370	22,099	20,317	13,621	3,100
Machinery and vehicles.....	431	6,457	1,461	3,733	2,052
Chemicals and related products.....	21,973	2,240	3,229	12	834
Miscellaneous.....	218,027	485,856	574,642	497,388	327,707
Total.....	6,398,421	5,351,172	4,735,057	4,590,070	3,530,332

¹ Source: Foreign Commerce and Navigation of the United States, U.S. Department of Commerce.

² Roughly between 45 and 48 percent of these exports goes to the Republic of Panama. The remainder consists of purchases by the Canal Zone and merchandise transshipped at the zone. All merchandise clearing from United States ports for Panama in merchant vessels is credited to Panama.

³ Chiefly bananas.

TABLE 2.—Costa Rica

UNITED STATES DOMESTIC EXPORTS TO COSTA RICA

Product	1928	1929	1930	1931	1932
Animals and animal products:					
Edible.....	\$713,412	\$790,376	\$588,927	\$401,260	\$263,378
Inedible.....	263,677	285,133	138,518	104,878	88,600
Vegetable food products and beverages.....	1,337,636	1,191,280	856,472	572,910	400,540
Vegetable products, inedible, except fibers and wood.....	413,473	386,959	287,543	160,854	98,164
Textiles.....	1,426,307	1,498,454	745,906	880,615	658,330
Wood and paper.....	339,891	410,913	183,988	147,296	115,187
Nonmetallic minerals.....	452,271	653,622	341,450	272,986	240,856
Metals and manufactures, except machinery and vehicles.....	829,264	800,693	347,758	244,124	139,929
Machinery and vehicles.....	1,508,502	1,480,526	604,037	344,011	159,952
Chemicals and related products.....	419,172	420,369	268,216	232,769	156,931
Miscellaneous.....	338,927	342,398	171,166	147,436	101,046
Total.....	8,042,532	8,260,723	4,533,981	3,509,139	2,422,913

UNITED STATES IMPORTS FROM COSTA RICA

Animals and animal products:					
Edible.....	\$15,683	\$8,476	\$12,865	\$6,790	\$7,695
Inedible.....	27,307	8,068	8,311	837	895
Vegetable food products and beverages ¹	5,392,878	5,080,224	4,663,886	3,676,615	3,598,130
Vegetable products, inedible, except fibers and wood.....	33,116	50	35,648	1,851	-----
Textiles.....	354	13,862	-----	-----	-----
Wood and paper.....	35,683	33,970	60,576	23,076	22,616
Nonmetallic minerals.....	774	-----	10	-----	-----
Metals and manufactures, except machinery and vehicles.....	1,035	23,937	1,162	800	-----
Machinery and vehicles.....	48,153	34,010	30,264	25,572	57,623
Miscellaneous.....	-----	-----	-----	-----	-----
Total.....	5,554,983	5,202,597	4,812,722	3,735,541	3,686,959

¹ Chiefly coffee and bananas.

TABLE 3.—Nicaragua

UNITED STATES DOMESTIC EXPORTS TO NICARAGUA

Products	1928	1929	1930	1931	1932
Animals and animal products:					
Edible.....	\$364,823	\$326,533	\$223,836	\$169,342	\$66,272
Inedible.....	394,171	459,451	292,241	204,065	119,719
Vegetable food products and beverages.....	1,089,539	959,183	735,704	616,937	289,583
Vegetable products, inedible, except fibers and wood.....	442,899	471,763	352,030	175,657	120,770
Textiles.....	1,269,096	1,530,086	816,987	889,763	653,859
Wood and paper.....	135,160	154,174	86,611	94,498	44,879
Nonmetallic minerals.....	1,073,050	490,711	346,742	235,374	118,069
Metals and manufactures, except machinery and vehicles.....	691,771	745,539	519,552	343,995	153,640
Machinery and vehicles.....	933,415	937,614	787,153	304,572	121,966
Chemicals and related products.....	496,472	518,152	372,996	323,789	203,411
Miscellaneous.....	404,709	358,931	278,458	172,377	80,192
Total.....	7,295,105	6,952,137	4,812,310	3,530,369	1,972,360

UNITED STATES IMPORTS FROM NICARAGUA

Animals and animal products:					
Edible.....	\$4,492	\$17,429	\$14,193	\$7,048	\$5,187
Inedible.....	278,190	128,165	119,546	43,495	16,654
Vegetable food products and beverages ¹	4,277,899	4,602,320	2,962,957	2,009,675	1,809,842
Vegetable products, inedible, except fibers and wood.....	63,040	49,403	79,289	63,136	31,371
Textiles.....	20	2	10	-----	-----
Wood and paper.....	722,416	781,613	183,884	44,073	25,780
Metals and manufactures, except machinery and vehicles.....	276	252	4,184	736	703
Machinery and vehicles.....	285	-----	125	-----	200
Miscellaneous.....	143,721	168,828	157,499	213,496	74,437
Total.....	5,490,339	5,748,012	3,521,687	2,381,659	1,964,174

¹ Chiefly coffee and bananas.

TABLE 4.—Honduras

UNITED STATES DOMESTIC EXPORTS TO HONDURAS

Product	1928	1929	1930	1931	1932
Animals and animal products:					
Edible.....	\$593,271	\$834,419	\$683,171	\$503,510	\$243,383
Inedible.....	611,130	812,505	583,326	384,191	259,831
Vegetable food products and beverages.....	1,086,305	1,238,746	1,083,192	787,127	499,252
Vegetable products, inedible, except fibers and wood.....	165,523	231,247	204,741	158,043	105,638
Textiles.....	2,147,957	2,936,346	1,700,068	1,190,939	1,036,554
Wood and paper.....	689,823	762,253	684,540	347,300	282,122
Nonmetallic minerals.....	1,270,545	1,808,408	701,581	550,604	439,077
Metals and manufactures, except machinery and vehicles.....	947,132	1,200,439	1,123,545	500,960	444,502
Machinery and vehicles.....	1,035,131	1,549,509	1,416,593	640,648	484,496
Chemicals and related products.....	611,231	728,324	736,922	546,910	432,251
Miscellaneous.....	525,896	616,511	574,242	301,041	204,472
Total.....	9,683,944	12,718,707	9,491,921	5,911,273	4,431,578

UNITED STATES IMPORTS FROM HONDURAS

Animals and animal products:					
Edible.....	\$1,170	\$622	\$83	\$108	\$6
Inedible.....	77,501	62,103	29,189	20,101	3,178
Vegetable food products and beverages ¹	11,820,853	12,137,194	12,029,721	11,607,752	8,832,339
Vegetable products, inedible, except fibers and wood.....	37,493	43,328	51,658	7,786	11,209
Textiles.....	1,127	5	3,018	3	-----
Wood and paper.....	139,033	307,443	188,330	27,273	1,906
Nonmetallic minerals.....	-----	-----	-----	7	70
Metals and manufactures, except machinery and vehicles.....	749	322	934	15	48
Machinery and vehicles.....	1,665	414	100	100	270
Miscellaneous.....	208,983	282,008	297,029	207,051	155,235
Total.....	12,288,574	12,833,439	12,600,062	11,870,196	9,004,261

¹ Chiefly bananas.

TABLE 5.—*El Salvador*

UNITED STATES DOMESTIC EXPORTS TO EL SALVADOR

Product	1928	1929	1930	1931	1932
Animals and animal products:					
Edible.....	\$93,461	\$289,286	\$141,910	\$150,083	\$23,195
Inedible.....	498,695	462,283	221,061	187,653	155,719
Vegetable food products and beverages.....	1,172,093	1,170,493	722,589	568,590	340,828
Vegetable products, inedible, except fibers and wood.....	215,889	202,365	147,090	87,186	55,546
Textiles.....	1,965,416	1,945,114	1,217,909	1,120,759	910,856
Wood and paper.....	316,738	326,768	144,919	73,292	59,677
Nonmetallic minerals.....	480,104	718,632	302,793	204,407	157,765
Metals and manufactures, except machinery and vehicles.....	577,019	826,346	411,270	219,193	85,789
Machinery and vehicles.....	1,436,774	1,258,127	647,580	412,706	189,197
Chemicals and related products.....	380,796	429,903	237,757	237,652	155,731
Miscellaneous.....	382,922	353,274	223,774	177,372	134,550
Total.....	7,519,937	7,983,091	4,419,052	3,468,912	2,268,853

UNITED STATES IMPORTS FROM EL SALVADOR

Animals and animal products:					
Edible.....				\$3,316	
Inedible.....	\$2,610	\$2,859	\$2,544	971	\$4,460
Vegetable food products and beverages.....	2,944,384	3,530,593	2,644,096	2,098,043	1,076,983
Vegetable products, inedible, except fibers and wood.....	68,008	62,136	42,909	47,372	24,658
Textiles.....	152,409	191,044	145,237	39,859	22,853
Wood and paper.....	1,061	24	6	785	1,253
Nonmetallic minerals.....	123	119			
Metals and manufactures, except machinery and vehicles.....	209		738		2
Machinery and vehicles.....		600	800	350	
Miscellaneous.....	31,847	42,563	38,590	40,429	13,286
Total.....	3,200,651	3,829,938	2,874,920	2,231,125	1,143,495

¹ Chiefly coffee.TABLE 6.—*Guatemala*

UNITED STATES DOMESTIC EXPORTS TO GUATEMALA

Product	1928	1929	1930	1931	1932
Animals and animal products:					
Edible.....	\$519,610	\$609,037	\$382,284	\$295,390	\$159,643
Inedible.....	457,112	499,052	278,403	267,122	128,083
Vegetable food products and beverages.....	3,091,192	2,388,250	1,224,777	867,421	574,278
Vegetable products, inedible, except fibers and wood.....	312,364	329,957	264,059	161,736	87,310
Textiles.....	2,401,526	2,312,739	1,873,319	1,169,700	660,288
Wood and paper.....	732,248	465,214	265,517	216,296	71,595
Nonmetallic minerals.....	907,808	747,356	602,638	429,879	315,161
Metals and manufactures, except machinery and vehicles.....	1,133,806	1,102,802	742,735	452,686	188,691
Machinery and vehicles.....	2,433,734	1,843,703	1,342,354	632,618	216,094
Chemicals and related products.....	614,367	488,408	381,143	338,892	188,385
Miscellaneous.....	591,245	559,016	384,793	304,476	144,242
Total.....	13,195,012	11,435,534	7,242,022	5,136,216	2,793,750

UNITED STATES IMPORTS FROM GUATEMALA

Animals and animal products:					
Inedible.....	\$13,796	\$50,158	\$43,546	\$16,952	\$6,954
Vegetable food products and beverages.....	9,325,849	8,311,837	7,201,380	4,538,359	4,418,529
Vegetable products, inedible, except fibers and wood.....	5,247	885	3,292		518
Textiles.....	265	6,337	248	219	313
Wood and paper.....	122,849	28,312	39,680	23,554	14,903
Nonmetallic minerals.....	11,455	11,994	526	25	
Metals and manufactures, except machinery and vehicles.....	432	344	2,470	1,864	22
Machinery and vehicles.....	9,673	1,234	328		100
Miscellaneous.....	71,198	58,476	109,018	70,060	58,060
Total.....	9,560,764	8,469,577	7,400,488	4,650,533	4,501,399

¹ Chiefly coffee and bananas.

APPENDIX D

Population of Central American Republics, as affected by proposed route of inter-American highway ¹TABLE 1.—*Panama (total population, 467,459)*

Provinces traversed by proposed inter-American highway		Provinces contiguous to proposed inter-American highway		Provinces not affected by proposed inter-American highway	
Department	Population	Department	Population	Department	Population
Cocle.....	48,244	Herrera.....	31,030	Bocas del Toro.....	15,851
Chiriqui.....	76,918			Colon.....	57,161
Panama.....	114,103			Darien.....	13,391
Veraguas.....	69,543			Los Santos.....	41,218
Total.....	308,808		31,030		127,621
Percent of total population.....	66.06		6.64		27.30

¹ Figures from Commercial Travelers' Guide to Latin America, U.S. Department of Commerce, Bureau of Foreign and Domestic Commerce, except for Costa Rica.TABLE 2.—*Costa Rica (total population, 516,031)*¹

Provinces traversed by proposed inter-American highway		Provinces contiguous to proposed inter-American highway		Provinces not affected by proposed inter-American highway	
Department	Population	Department	Population	Department	Population
San Jose.....	167,669	Cartago.....	77,626	Limon.....	33,382
Alajuela.....	107,285	Heredia.....	41,697		
Guanacaste.....	57,045				
Puntarenas.....	31,327				
Total.....	553,326		119,323		33,382
Percent of total population.....	70.41		23.12		6.47

¹ Figures from Costa Rica en el Bolsillo, San Jose 1931.TABLE 3.—*Nicaragua (total population, 638,119)*

Provinces traversed by proposed inter-American highway		Provinces contiguous to proposed inter-American highway		Provinces not affected by proposed inter-American highway	
Department	Population	Department	Population	Department	Population
Carazo.....	32,059	Chontales.....	77,641	Bluefields.....	31,078
Chinandega.....	47,583	Estel.....	30,515	Jinotega.....	27,205
Granada.....	34,035	Matagalpa.....	78,226	Nueva Segovia.....	42,685
Leon.....	78,300				
Managua.....	74,696			Territories of Cabo Gracias.....	11,728
Masaya.....	40,386			San Juan del Norte.....	892
Rivas.....	31,090				
Total.....	338,149		186,382		113,588
Percent of total population.....	53.00		29.20		17.80

PROPOSED INTER-AMERICAN HIGHWAY

TABLE 4.—Honduras (total population, 859,761)

Provinces traversed by proposed inter-American highway		Provinces contiguous to proposed inter-American highway		Provinces not affected by proposed inter-American highway	
Department	Population	Department	Population	Department	Population
Choluteca.....	69,010	Tegucigalpa.....	119,844	Gracias.....	64,322
Valle.....	40,169	El Paraiso.....	56,642	Cortes.....	57,963
		La Paz.....	39,014	Atlantida.....	32,474
				Olancho.....	54,014
				Islas de la Bahia.....	5,527
				Yoro.....	42,302
				Santa Barbara.....	60,844
				Ocatepeque.....	37,565
				Comayagua.....	41,873
				Colon.....	32,295
				Copan.....	67,232
				Intibuca.....	38,671
Total.....	109,179		215,500		535,082
Percent of total population.....	12.70		25.06		62.24

TABLE 5.—El Salvador (total population, 1,437,611)

Provinces traversed by proposed inter-American highway		Provinces contiguous to proposed inter-American highway	
Department	Population	Department	Population
Santa Ana.....	154,663	Ahuachapán.....	80,024
La Libertad.....	119,178	Sonsonate.....	100,896
San Salvador.....	191,320	Chalatenango.....	82,298
Cuscatlan.....	83,653	La Paz.....	88,229
San Vicente.....	77,534	Cabanas.....	58,611
San Miguel.....	128,048	Morazan.....	75,013
Usulután.....	124,859		
La Unión.....	73,285		
Total.....	952,540		485,071
Percent of total population.....	66.26		33.74

TABLE 6.—Guatemala (total population, 2,004,900)

Provinces traversed by proposed inter-American highway		Provinces contiguous to proposed inter-American highway		Provinces not affected by proposed inter-American highway	
Department	Population	Department	Population	Department	Population
Amatitlán.....	37,705	Baja Verapaz.....	68,531	Alta Verapaz.....	161,405
Chimaltenango.....	88,030	Chiquimula.....	94,182	Izabal.....	19,932
Guatemala.....	216,807	Escuintla.....	58,989	Peten.....	7,820
Jutiapa.....	94,213	Huehuetenango.....	137,166	Zacapa.....	65,723
Quezaltenango.....	168,754	Jalapa.....	43,041		
Sacatepequez.....	46,453	Quiché.....	138,076		
San Marcos.....	176,402	Retalhuleu.....	37,145		
Santa Rosa.....	81,343	Suchitepequez.....	64,820		
Solola.....	104,283				
Totonicapán.....	94,080				
Total.....	1,108,070		641,950		254,880
Percent of total population.....	55.27		32.02		12.71

TABLE 7.—Summary (total population of 6 Central American Republics, 5,923,881)¹

	Population affected by proposed inter-American highway	Population contiguous to proposed inter-American highway	Population not affected by proposed inter-American highway
Total.....	3,147,387	1,638,538	1,063,449
Percent of total population.....	53.53	28.38	18.09

¹ These population statistics were derived originally from Central American census reports, in some instances as early as 1920. The present total population of Central America is believed to exceed 6,000,000.



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